THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. XCIV. No. 2240.] LONDON, APRIL 17, 1906. [58TH YEAR. PRICE 6d.

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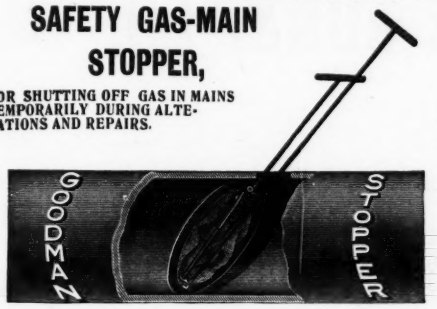

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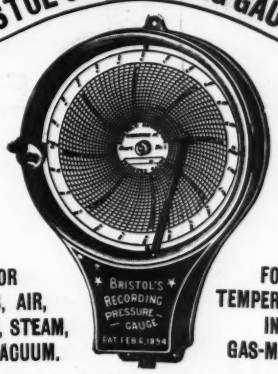

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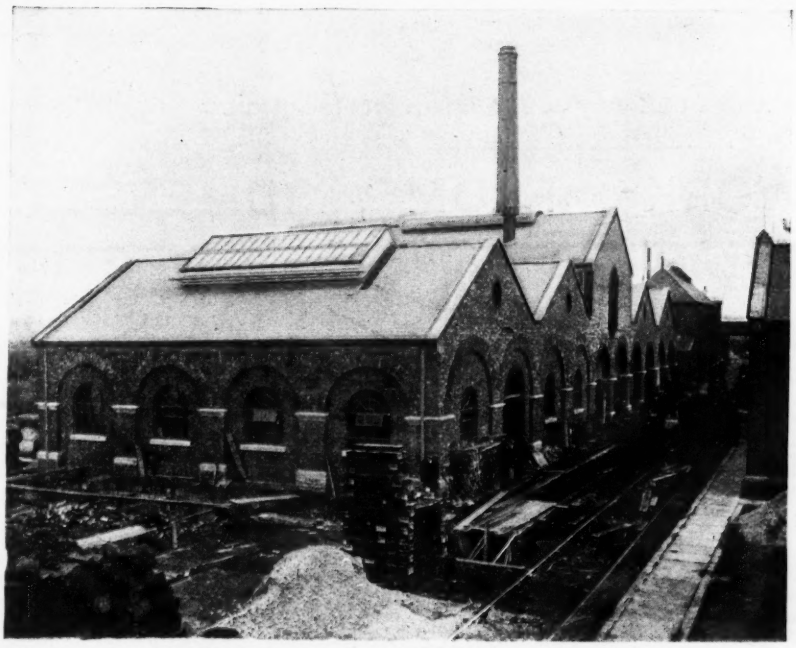

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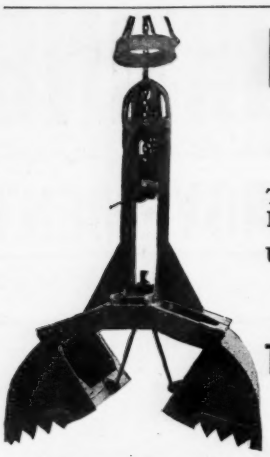

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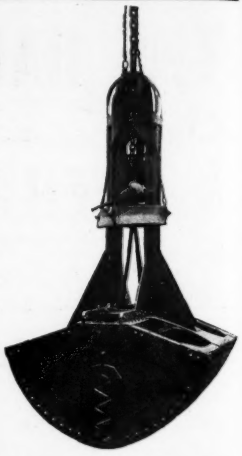

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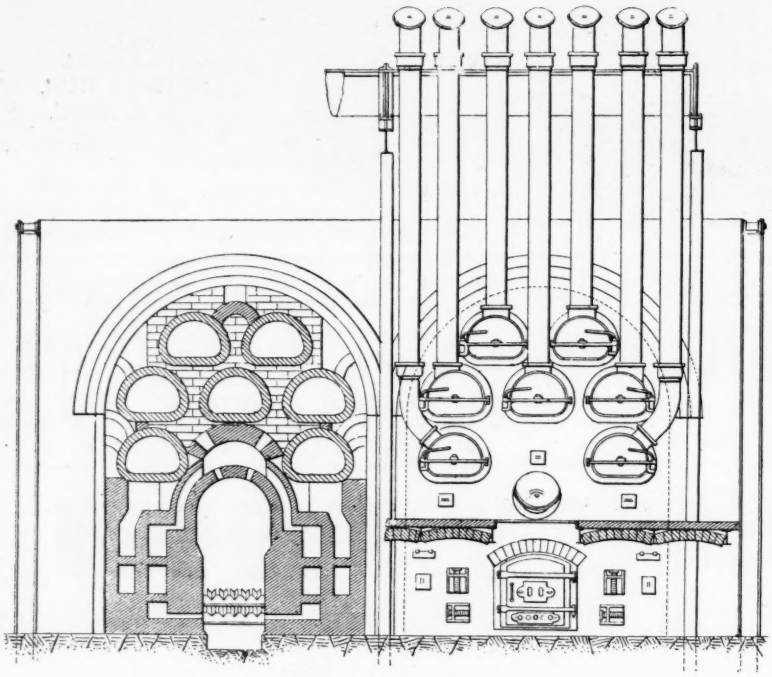

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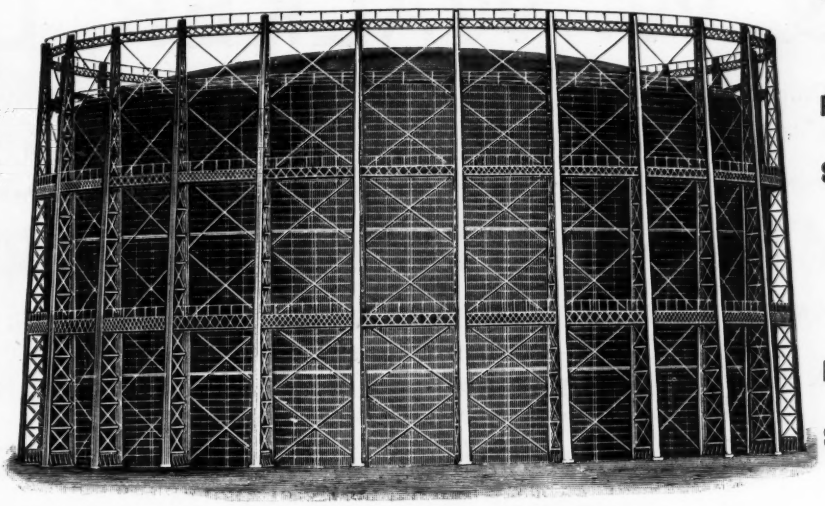

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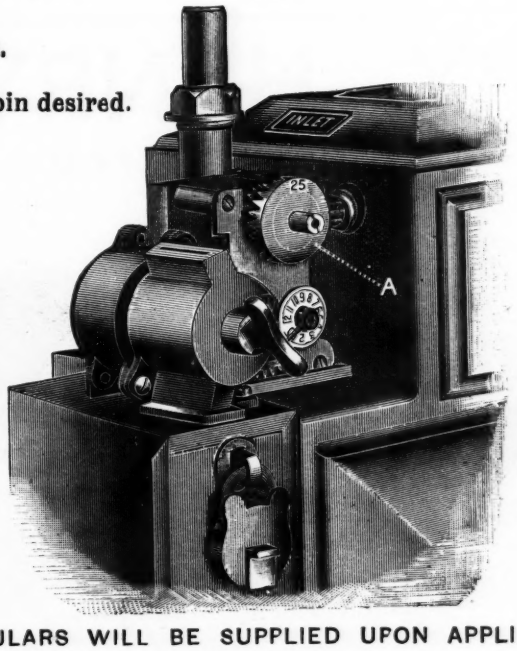

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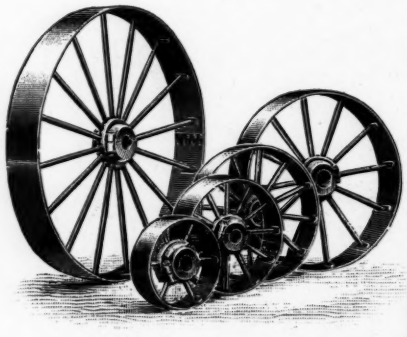

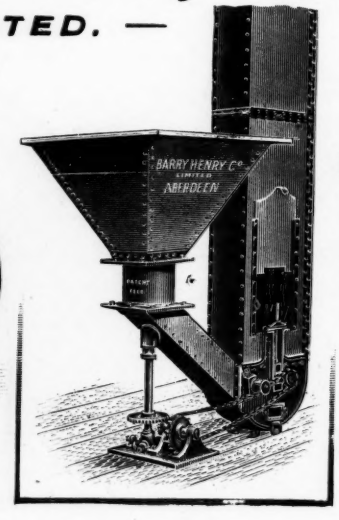

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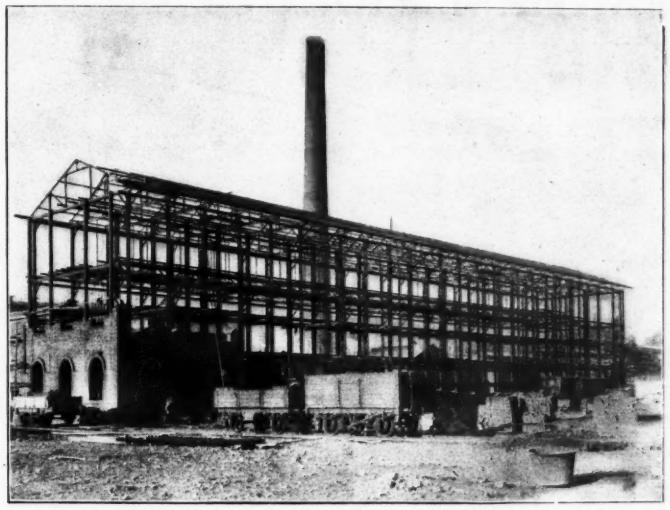

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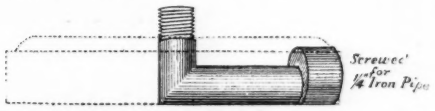

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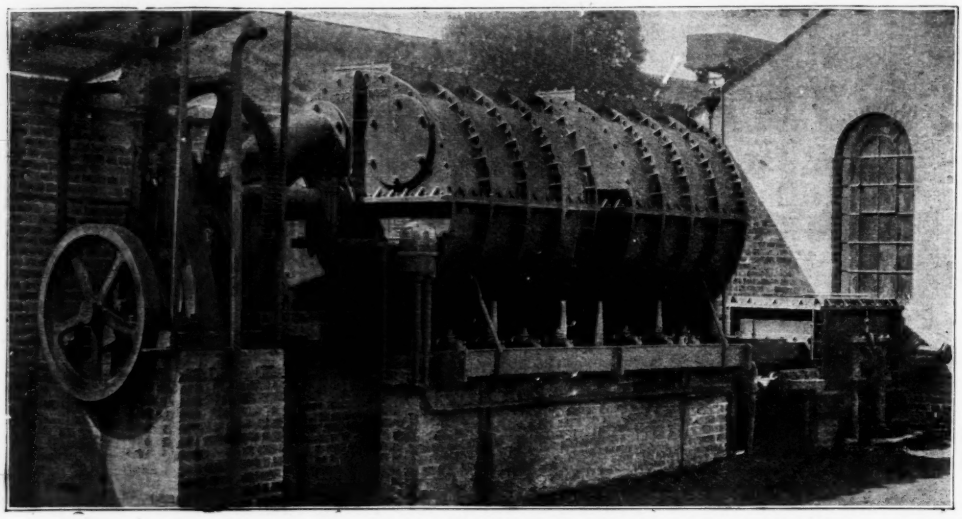

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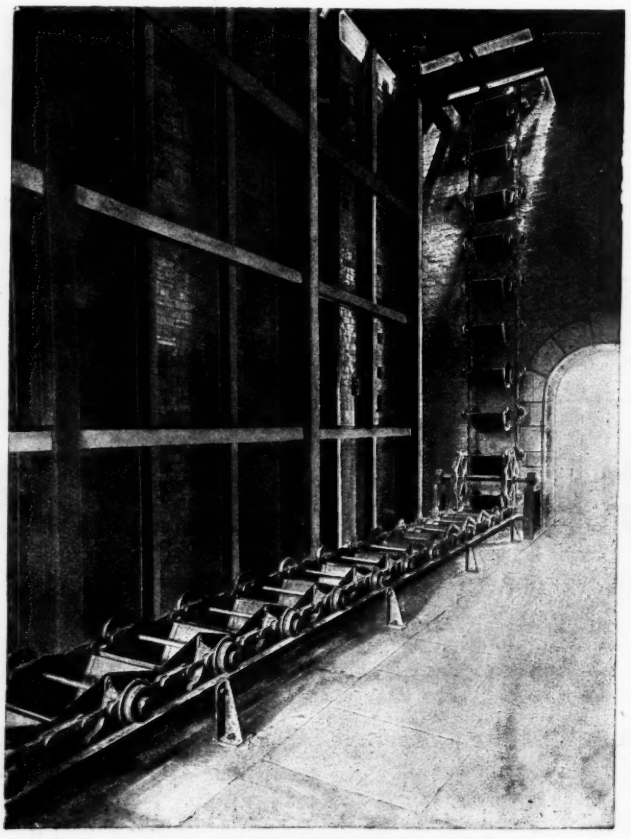

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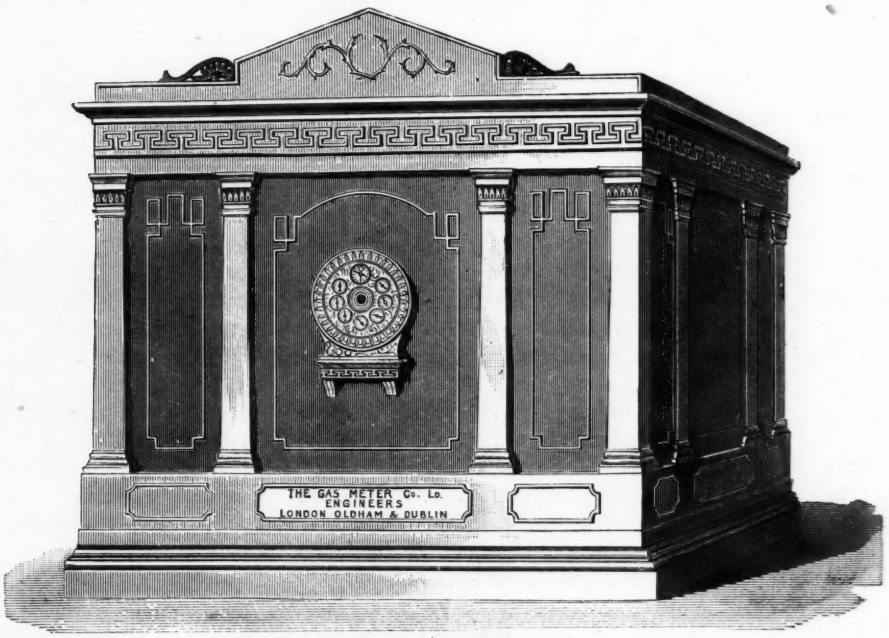

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Aylesbury	150,000	G. L. & C. Co., Bromley	3,750,000	Reichenberg, Bohemia	200,000
Barrow	300,000	G. L. & C. Co., Fulham	1,750,000	Romford	300,000
Bath	1,000,000	G. L. & C. Co., Nine Elms	2,750,000	Rotterdam, Holland	850,000
Belfast	1,700,000	Geneva, Switz.	500,000	Rotterdam, Holland (Second)	1,500,000
Belfast (Second)	4,500,000	Gosport	200,000	Rotterdam, Holland (Third)	750,000
Birmingham	1,500,000	Göteborg, Sweden	300,000	St. Gallen, Switz.	225,000
Bordentown, N.J.	125,000	Guildford	350,000	St. Joseph, Mo.	750,000
Bournemouth	1,000,000	Hamburg, Germany	1,750,000	Santiago de Cuba	400,000
Bremen, Germany	550,000	Hartlepool	750,000	Scarborough	800,000
Bremen, Germany (Second)	950,000	Hebden Bridge	200,000	Shanghai	225,000
Brentford	1,200,000	Heidelberg, Germany	200,000	Shanghai (Second)	225,000
Bridlington	150,000	Holyoke, Mass.	600,000	Southampton	800,000
Bridlington (Second)	200,000	Hull	1,500,000	Southampton (Second)	500,000
Brighton	1,750,000	L. & N.W. Rly., Crewe	700,000	Southgate	400,000
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Deventer, Holland	150,000	Newburgh (Second)	250,000	Tottenham (Second)	750,000
Deventer, Holland (Second)	200,000	New York	1,200,000	Tottenham (Third)	350,000
Dorking	150,000	New York	4,000,000	Tottenham (Fourth)	1,000,000
Dublin	2,000,000	North Middlesex	150,000	Tunbridge Wells	1,000,000
Dublin (Second)	2,000,000	North Middlesex (Second)	200,000	Utrecht, Holland	1,000,000
Dunedin, N.Z.	150,000	Norwich	1,000,000	Utrecht, Holland (Second)	1,000,000
Dunedin, N.Z. (Second)	275,000	Ostend, Belgium	100,000	Waltham	400,000
Durham	200,000	Perth, W.A.	125,000	Wandsworth & Putney	1,800,000
Eastbourne	1,250,000	Port Elizabeth, S.A.	400,000	Watford	300,000
Edinburgh	2,000,000	Portsmouth	1,000,000	Watford (Second)	350,000
Epsom	225,000	Posen, Germany	450,000	West Ham	1,500,000
Falmouth	150,000	Posen, Germany (Second)	700,000	Winchester	225,000
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Bognor	100,000	Brieg, Silesia	100,000	Leiden, Holland	500,000
Bournemouth (2nd)	500,000	Brussels—Ville (4th)	350,000	Poole	1,500,000
Vienna	3,500,000	Innsbruck, Austria	200,000	Berlin-Rixdorf	650,000
Maastricht, Holland	200,000	Marlborough	100,000	Berlin-Charlottenburg	2,500,000
Antwerp, Belgium (2nd)	1,000,000	Flensburg, Sleswig	300,000	Bochum, Westphalia	530,000
Tottenham (5th)	1,000,000	Weston-super-Mare	300,000	Brussels—Anderlecht	350,000
The Hague, Holland (2nd)	500,000	Wexford, Ireland	100,000	Leigh, Lancs.	350,000
Hampton Court	500,000	Budapest, Hungary	50,000	Stockport (3rd)	400,000
Lea Bridge (3rd)	400,000	Swindon	300,000	Agram, Croatia.	200,000
Dublin (3rd)	650,000	Reading	1,000,000	Bruges, Belgium	200,000
North Middlesex (3rd)	75,000	Oberhausen, Germany	175,000	Liége, Belgium (2nd)	750,000
St. Gallen, Switz. (2nd)	225,000	Malmo, Sweden	350,000	Lemberg, Galicia	260,000
Brussels—St. Josse	1,000,000	Ipswich	750,000	Leeuwarden, Holland	400,000
Dundee	1,500,000	Winchester (2nd)	125,000	Stockholm	1,500,000
Bridgwater	200,000	Zwolle, Holland (2nd)	200,000	Romford (2nd)	350,000

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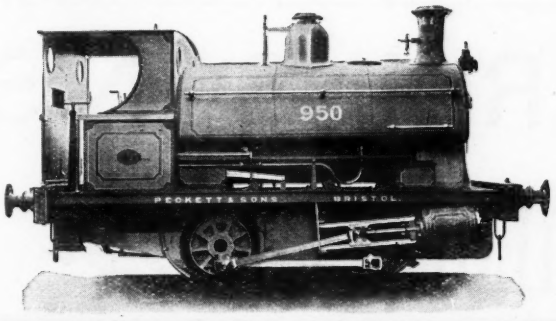

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EDITORIAL NOTES—GAS, &c.

Parliamentary Topics—Sulphur Restrictions.

FROM last Wednesday and a week from to-day, the voices of our Legislators will not be heard in the Houses of Parliament. Cessation from labour is good for those constituting our chief national assembly, just as it is for the individuals who "week in week out, from morn till night," follow a common round of occupation. These breaks—short though they be—in the ordinary rush and turmoil of life assist to physical recuperation, and enable those who can spare time from their pleasures to ponder over the more prosaic affairs of life, to consider them with a dispassionateness that is not always possible amid the ordinary whirl of business life, with divers influences bearing on all sides. Those among us who are employers of labour, those among us who hold that the well-being of our country depends in large measure upon the maintenance of private enterprise and individual effort, will not—on giving serious consideration to all that the recent weeks have brought forth in the Lower House of Parliament—look with equanimity upon what has been done and the prospect. The break that is caused by the Easter recess in the rush to legislate for the workers of the country and to privilege the "progressive" elements in local government, will not, there is little hope, bring about moderation in these directions; for moderate liberalism as represented in the House appears, in these two particular matters (Imperial questions do not concern us here), to have suddenly become subservient to the wildest flights of the extremists who have found place in the Legislature. The prevailing attitude is to give to pacify, in order to retain unimpaired an almost, if not quite, unique dominating strength.

In the Trades Disputes Bills, an attempt is being made to set Trades Unions above the common law, and to give militant labour an immunity from ordinary control which will work unfairly upon both employer and peace-loving employee. The Compensation Bill is also in favour of employees, extending among them, as it proposes to do, the operation of the existing General Acts. Fundamentally its objects commend themselves almost generally to the House, though it is recognized that at times a little hardship may be inflicted on the small employer. But experience of the predecessors of this Bill has not shown that they have wrought any great oppression on employers, though they have been a prolific cause of litigation in obtaining legal decree as to whether or not specific cases come within the meaning of the Acts. The Bill has been read a second time, and has been referred to the Standing Committee on Law. It is thought that the practice of sending to Standing Committees Bills of such moment and weight, and involving such large issues as this, is overwhelming those Committees, and therefore that such measures should be discussed in Committee of the whole House. Much may be said for both sides of this question. There is no doubt that in the House, such a Bill would receive the broadest consideration; but it might prove an almost interminable business to dispose of a measure, the details, if not the principles, of which are of a contentious character.

Then employers—gas companies and authorities equally with others—are concerned in the Notification of Accidents Bill, which is designed to make more stringent the obligations of employers in respect of accidents than exists at present under the Notice of Accidents Act, 1894. This Bill (as will be remarked from the report elsewhere) will, if it becomes law, bring under official cognizance the most paltry of accidents, and will cause both officials and employers a deal of unnecessary responsibility, vexation, labour, and possibly friction between employer and employed. Any industrial accident which causes a man to be absent from work for only a day will have to be notified. The measure as originally framed has been modified in respect of another time-limit; and, indeed, there has been an effort to abolish time-limits altogether. The Bill brings us to the verge of that position already; but it would be an unbearable situation for a large employer to be constantly worried over trivial mishaps, of which workmen now take no notice, and which do not call for absence from employment for even a day. The Bill will have to be kept in view by all who are employers in industrial pursuits, for it presages greatly increased responsibility.

Favouritism to municipalization and injustice to private enterprise have also been among the prominences of the early days of the new Parliament. Already one privately promoted Bill has been sacrificed because the promoters had the courage to appeal to Parliament for justice, and asked to have their Bill considered in Committee concurrently with one by the London County Council. But, unfortunately, Samson was at the time, and still is, under the influence of Delilah; so much so that it is feared that the London County Council will in the Commons this session do much as they like. Then there has also been introduced a Bill to give a remarkable freedom to municipalities in the matter of entering into trading in the name of the ratepayers. These are only a few of the many indications of the trend of domestic matters in the new Parliament; and they are serious enough. It is patent that a majority of the members do not appreciate, or in the flush of victory have forgotten, that in power is great responsibility.

So far the session has not been brisk in connection with Private Bill work affecting gas undertakings. Few gas measures have come before Select Committees, owing to the number in connection with which promoters and opponents have been fortunate enough to smooth out all differences which have arisen. There are only two or three features in the work done to this stage that are really notable. One is the introduction of a model form of gas-testing clause, which, however, it is hoped will not be applied in such hard-and-fast manner that adherence will be compulsory, where the clause is adopted, to the prescriptions of the Gas Referees in regard to the table photometer. In the second place, it is deserving of mention here that the Watford Gas Company are going along merrily with their Bill, which will, if still successful, empower the supply of 13-candle gas. The most important news, however, has reference to the question of the removal of the sulphur restrictions. A peculiar dulness of perception had raised a somewhat formidable opposition to the Bill jointly promoted by several Companies; but on a better understanding of the position, there has been almost week by week a breaking away of the opposition. The Wallsend Corporation is the latest seceder from the hostile rank. There are really few inimical authorities left now; and perhaps their number will be further lessened before the sitting of the Commons Committee who will commence the consideration of the question on the 26th inst. There is a notable point about the reference to this Committee, and also about the composition of the Committee. The first is that the group of Bills entrusted to them consists of the Gas Companies (Removal of Sulphur Restrictions) Bill, and the Derby, Southampton, Tottenham and Edmonton, and Cheltenham Bills. Now all these Bills, in addition to the joint one, contain provisions to annul the sulphur clauses. But the Committee will not be troubled with a majority of the measures, seeing that there has been a settlement of the opposition. As to the composition of the Committee, it is interesting to observe that Mr. F. Cawley will be the Chairman; and he also presided over the Commons Committee before whom the Bills last year were discussed which gave relief to the Metropolitan Companies and to the South Suburban Company. His colleagues will be Mr. D. J. Cogan, Mr. Rowland Hunt, and Mr. Dudley Ward; and the last-named gentleman is one of the members for Southampton. As mentioned above, the Southampton Gas Company's Bill is of the group. We have never felt any doubt as to the success of the Joint Bill; and, if there had been any before, there is reason for less now, seeing that Mr. Cawley will have fresh in memory the proceedings on the

Bills of last year, and he it was who, when the subject of the testing of gas was under discussion, indicated his great appreciation of the highly "scientific and technical" character of the Departmental Committee, whose decisions so largely—in fact, almost completely—directed the Commons Committee in their findings on the far-reaching Bill of the London County Council.

The Question of the Question-Box.

In this and last week's issue of the "Journal," some attention has been given to the newly-issued "Question-Box" volume of the Ohio Gaslight Association; and there are still other sections to come under review. Meanwhile, there are a few reflections that the perusal of the sections so far dealt with has given rise to, to which expression may be given, and perhaps with profit. Criticism, if taken in the correct light, may be constructive as well as destructive; helpful as well as preventive. It should be a good incentive to effort to attain perfection. And it is in this light that we would have our friends across the water look upon these comments on their volume; for the "Question-Box" as a means of garnering knowledge has always received from us the utmost countenance and friendly aid.

The new volume, as have its precursors, presents us with such a broad expanse of variegated matter, that the reviewer is considerably exercised as to the constituents of that matter upon which to alight for remark, or to put specially before his readers. Selection, as a rule, must be very much a matter of the individual taste, of prepossession, and of the personal estimate of relative importance. What is a difficulty for the reviewer, is perhaps a still greater difficulty for the compilers and editors of such a volume as that of the "Question-Box." The trained editor endeavours to look at the matter before him in a broad spirit, and from all points of view. He may not be always successful or happy in his selection; but the material he gives to his readers is that which, bringing experience to bear upon his work, he deems will satisfy the distinct and varied requirements of all sections of his readers (who also have their individual tastes and their predilections), rejecting that which, in his judgment, will be of no avail. In the compilation of the "Question Box," there has to be the same generous consideration for all who will consult the resulting volume for either light or leading; and, bearing this in mind, those learned in the technique of, and having great talent for administration in, the gas industry, must not be hypercritical or querulous over the subject-matter of the volume. But having said this, we must still insist that, if those who have undertaken this voluntary work are free agents in the matter, the exercise of their selective powers—retaining in mind what has already been said as to the diversity of the requirements of those they serve—would result in greater value being given to the volume.

The "Question Box" is a storehouse—unique as a means of bringing together information and personal experiences; but the usefulness of a storehouse has a very large relation to its methodical arrangement. There is no gas organization in existence that, by its conventional system, raises in a single twelvemonth for consideration and discussion, as does the present volume, between 500 and 600 points associated with the technical and managerial issues and experiences in the work of the industry. The paper-and-discussion system—good as it is in concentrating thought and examination upon particular subjects—confines and restrains, and shuts out the hundred-and-one experiences of every-day work obtained in the numerous centres of the gas industry's activities throughout the country. The "Question-Box" gives the opportunity and latitude that the conventional methods of technical organization deny. And that is the most valuable feature of the "Question-Box." But there is the reverse side of the picture. As the accumulated store is presented to us in the Ohio volume, its value is much depreciated by the want of methodical arrangement. It is true that there is a subject-matter index; but that does not pardon or justify the want of system in the principal part of the volume itself. With little trouble, the labours of the student might be greatly assisted by the rearrangement of the questions and answers in subject groups. Explanation of our meaning may be made by a reference to carburetted water gas, which, with pendant matters, supplies a large proportion of the questions in the manufacturing sections of the present volume. But the position of the questions in the sections is accidental and not designed, and there is no attempt at assortment. The result is that, for example, questions of oil are met with mixed, in most disorderly fashion, with questions referring to subjects having no identity. The sorting of the subjects and bringing them into contiguity by classification is therefore another way in which worth might be greatly enhanced.

The value of the "Question-Box" has been spoken of, one or two of the ways in which it might easily be improved have been pointed out, and now it has to be said that where it fails is that the system does not provide an absolute guide for either the student or the inquirer. Light the volume may give; leading it does not but in rare instances. Questions are put; and the inquirer is left with all the answers before him floundering about in a sea of uncertainty. There is no absolute guide. In some cases the choice is given of diametrically opposite views. One correspondent affirms, while another negatives. One man's experience advises one course; while another man counsels its avoidance. To the student and the searcher after truth, the volume therefore fails as a mentor. The position very largely resolves itself into taking for direction the views or the experience of the majority, or else treating the replies elicited as the contents of a prize-tub—dip, and trust to fortune to have secured the best that is to be had.

There is, it is obvious, still much to be done to perfect the "Question-Box" volume, and to enhance its utility. The latter will follow the former. As improvement is made, there will be a *pari passu* progression in value and utility. At the present time, the volume is not all we hope it will be.

Vertical Retorts and Misrepresentations.

There is reason for regret that the translation of part of the report of the discussion on Herr E. Körting's paper on vertical retorts (published last week) was unavoidably delayed, and so prevented notice then being taken in the editorial columns of certain allegations levelled against the "Journal" by Dr. Bueb and Herr W. von Oechelhaeuser. Both gentlemen—it is hoped unwittingly, though it is difficult to see how that can be—have misrepresented the position that we have taken up in this matter of the Dessau vertical retort system. To us, the vertical retort question is purely one of technical importance. We have no individual inventor's interests to serve; and the commercial aspect does not enter into consideration. Looking from a distance at what has recently occurred in Germany in connection with this matter, it presents very much the appearance of a determined effort to counteract the advice that has been given, that gas engineers will do well to defer binding themselves to any one vertical system—no matter which one—or recommending the expenditure of capital on any system, until actual results are obtainable from those in process of development, so that their results may be judged relativeiy. The advice, under the circumstances, commends itself as sound; and in that advice—we challenge contradiction—is concentrated the attitude adopted by the "Journal" ever since the Dessau results were published at the end of last September. The correctness of the advice is emphasized by the discussion published last week. It is a pleasure to see that Herr Körting, notwithstanding his somewhat critical examination of the principles of operation of the Woodall-Duckham setting, makes his position quite clear. He plainly states the resolve of the Board of the Imperial Continental Gas Association, that their interest in the Dessau system will not deter its abandonment should eventually another system of working show superior results. Herr von Oechelhaeuser, too, declares he and the German Continental Gas Company will be the first to adopt whatever is better, whencesoever it comes. But this kind of thing cannot go on indefinitely. All concerns are not of such magnitude as those named, nor the possessors of such vast resources, that they can afford to take courses which may be very right and proper, in the cause of progress, for others to pursue, and more particularly when directly interested in other ways.

We are also at a loss to understand why there has been, in Germany, such a picking to pieces of the Woodall-Duckham form of setting by those concerned in the Dessau system—seeing that no authoritative figures have yet been made public. Herr Körting himself says that "he is not "in a position yet to discriminate between the systems. "The working figures for the Woodall-Duckham setting "are not available . . . Until the data are known, *no "opinion can be formed as to either the industrial advantages or*

"*disadvantages of the setting*." Then all the more reason for delay in making a choice, and for allowing Herr Körting's criticism to remain in abeyance. The Dessau figures have been published; and they, too, taken in conjunction with Mr. Young's criticism, are a sufficient justification for adopting a waiting policy. Moreover, the Woodall-Duckham system is not the only one before us. There is the Settle-Padfield, and that system may have (we cannot say positively) a complete trial in Germany before the Woodall-Duckham form of setting. If in the event this should prove true, this will make still more peculiar the criticism at this stage of the Woodall-Duckham process. Then both Mr. Young and Mr. Samuel Glover are projecting a method of construction of vertical settings, with special objects in view; and other investigators are devoting themselves to the subject. Until, therefore, "an opinion can be formed," quoting Herr Körting again, "as to the advantages or disadvantages" of the various settings, it would be assuredly premature to invest capital to any extent in the first form of setting that happens to offer itself.

Misrepresentation has been spoken of. It is a harsh word, perhaps; but it is the only fitting one. Interest should not in these matters, be permitted to blunt one's sense of fairness, or to efface the truth, or to misinterpret. There is a right to an explanation from Dr. Bueb as to where he has found in the "JOURNAL" any categorical assertion "to the effect "that the Woodall-Duckham process is superior to the Bueb "process." We think that he will find, on refreshing his memory, that the line taken by the "JOURNAL" has been the one already indicated—that the results obtained experimentally by the Woodall-Duckham and Settle-Padfield systems are such that a waiting policy is advisable. Then as to Herr von Oechelhaeuser's statement that "they would "probably have waited for still longer working results, but "for the allusions to the secrecy of their conduct in the "very journals which later found fault with the working "experience being too short." We may safely leave Dr. Bueb's paper, read in September last, to answer, to the satisfaction of unbiassed readers, the first part of Herr von Oechelhaeuser's remark. Dr. Bueb then said: "In the "whole period of three months' working at the Dessau Gas-"Works, not a single untoward incident has occurred, so "that we are now able to bring before the public, and recom-"mend the settings as trustworthy and well tried in work-"ing." We will leave Herr von Oechelhaeuser to reconcile his accusation with Dr. Bueb's avowal. So far as the "JOURNAL" is concerned, we do not remember ever having made any allusions to the "secrecy" of the conduct of the Dessau experimenters such as to hasten on the publication of their results; and, even if we had, it had no effect, for Dr. Bueb was perfectly satisfied last September that the time had then—and not till then—arrived for the publication of the working figures. Then, regarding the fault-finding as to the working experience being too short, that distinctly had reference to the trial being too short for so positive a declaration as Dr. Bueb made, that, after "three "months'" trial of the latest form of setting, it was "trust-"worthy and well-tried in working," and for any immediate confidence that the results then obtained would be continued when the retorts began to deteriorate or to get deformed. There was also the undetermined question of durability.

Our position in this matter has been explained on more than one occasion; but persistency characterizes misrepresentation, and previous refutation is, it seems, wholly ignored. We have no hesitation in saying that no one without interest in the Dessau vertical retort system has really misunderstood our position.

Utilization of Peat.

In submitting to the members of the Engineering and Scientific Association of Ireland the paper on the subject of "Power-Gas Plants," from which some extracts are given elsewhere, Mr. Thomas Rigby brought home to them a question of national importance. Ireland depends largely upon imported coal—the quantity raised having decreased by about 20,000 tons in the ten years ending with 1904. Yet it appears that there are about 175 million tons of coal in the earth, only waiting to be brought to the surface. But most of it is soft, of the bituminous kind; though there are extensive deposits of good anthracite fuel in Kilkenny, Queen's County, and Carlow, some of which has been employed in producer plants with satisfactory results. Ireland, however, possesses what Mr. Rigby very appropriately called a "valuable national asset" in her vast deposits of peat, of which there are about 2,800,000 English acres, of an average depth of 20 feet Why could not this material be used for the production of gas suitable for power? This was the question he put to the members of the Association. He pointed out to them that in most of the districts where peat bogs are situated cheap labour could be obtained; and he thought it would be practicable for companies to remove their works to the bogs, so as to get power cheaply—much as works are put up in the vicinity of waterfalls to utilize this source. But Mr. Rigby showed that the peat could be utilized otherwise than for the production of power gas. He thought it could be made to yield sulphate of ammonia; and he submitted an estimate of the cost of a year's working of an ammonia-recovery plant, which showed a balance of about £27,000. Even supposing the amount actually realized was much lower than this, the scheme might be worth a trial, if only for the purpose of stimulating industry in the country. The employment found for the people would have the effect of stemming the tide of emigration; and the land from which the peat was taken would, with proper drainage, be gradually rendered suitable for agricultural purposes. In any event, Mr. Rigby has done well to bring under the notice of the members of a scientific body in the Sister Isle the possibilities of one of the principal natural resources of the country.

Limits of Municipal Enterprise.

Some excitement has been caused in Hull by the Local Government Board's comments on the Bill which is being promoted by the Corporation to enable them to construct a wharf and pier, together with railways in connection therewith. The scheme, it appears, was only favoured by a small majority of the Council; and now the Local Government Board, in the report on the Bill which they have in the ordinary course of things presented to Parliament, remark that the construction and maintenance and carrying on of such undertakings "are matters not coming within the scope of the ordinary duties of municipal corporations." Of course, this much is fairly obvious; but, in addition, attention is drawn to the rapid increase which has taken place of late years in the indebtedness of local authorities, and the many calls which have already been made, and are likely to be made in the future, upon such local authorities to carry out works and to incur debt for purposes coming within the scope of their own duties. These are the reasons which, in the opinion of the Board, "render it inexpedient, as a general rule, to confer upon those authorities the power of raising money to be applied to other purposes." They suggest that before granting the powers asked for, the Committee should have information laid before them as to what sums the Corporation are likely to require to borrow for the sanitary necessities of the city, or otherwise for the purposes of the duties imposed upon them by the general law. The Corporation, of course, point out that local authorities are in the habit of applying for, and having conferred upon them, powers to carry on undertakings which do not come within "the ordinary scope of the operations of municipalities," and that some have already received power to construct wharves and piers. This is undoubtedly so; but it will be interesting to see what will be the fate of the Hull Corporation scheme in the face of the report made by the Local Government Board. The reminder of the calls which are likely to be made on municipalities in connection with their proper duties, and the consequent need for carefulness in the spending of money in other directions, is by no means ill-timed.

Water Engineering Expenses at Tenby.

For upwards of two years the Corporation of Tenby have been in a dilemma from which they have only just been extricated by the decision given in the King's Bench Division of the High Court of Justice, and reported in our "Legal Intelligence." The trouble arose originally in connection with the attempts made by the Corporation to procure a better water supply for the town. For this purpose the services of professional men had to be engaged, and their fees paid. At the end of the financial year 1902-3, some of these amounts stood in the books of the Treasurer as an overdrawn account. With the view of eventually obtaining the sanction of the Local Government Board to the

expenditure, the Corporation asked the then Treasurer to allow the sums in question to be carried to a suspense account, so that it might be made the subject of an application for a loan at some future date. This he refused to do; whereupon the Corporation arranged with Lloyds Bank to pay off the old Treasurer, and do what they required. Application was then made to the High Court for a *certiorari* to quash this order; and a rule was granted. It was subsequently made absolute, on the ground that the execution of the order would create an illegal overdraft—that, in fact, it would amount to the Corporation borrowing money without the sanction of the Local Government Board to pay off certain expenses, instead of including them in their annual estimates. This decision was given about two years ago by the Lord Chief Justice and Justices Wills and Kennedy. Since then the Corporation have found themselves in possession of a surplus in the borough fund; and with this they desire to relieve themselves of their liabilities. They accordingly applied to have the rule quashed; and their application was granted by a Divisional Court, composed of Justices Ridley, Darling, and Lawrence. Of course, there had been no misapplication of the money; the Corporation's mistake was in not acting strictly in accordance with rule. Justice Ridley, however, considered that the expenditure had been properly incurred "for the public benefit of the inhabitants of the borough," and therefore came within the meaning of section 143 of the Municipal Corporations Act. He expressed the hope that this was the last time the Court would hear anything of the matter; and doubtless the Corporation share it.

The death took place last Wednesday of Mr. R. J. Bazley, one of the Directors of the Plymouth and Stonehouse Gas Company. Deceased had been a somewhat prominent figure in the public life of Plymouth, and was a member of the Town Council and other public bodies.

The will of the late Sir William Thomas Makins, Bart., has been proved. The deceased left property of the gross value of £99,776, of which £47,499 is net personalty. After making a number of bequests, the testator left the residue of the estate to his eldest son, Paul Augustine, who succeeds to the title.

The next meeting of the Yorkshire Junior Gas Association will be held on Saturday, the 21st inst., at the Town Hall, Dewsbury. A paper on "Unaccounted-for Gas" will be read by Mr. George Herris, of Redcar; and following this the discussion of questions, opened at the last meeting, will be continued.

Mr. Alexander I. Strachan, the Treasurer of the Dundee Corporation Gas Department, died at his residence in Dundee last Thursday week. Mr. Strachan became apprentice clerk in the office of the Dundee New Gaslight Company in June, 1852. When, in 1868, the undertaking was acquired by the Corporation, he was principal clerk in the office, and was retained in that position. He was appointed to the office of Treasurer in 1888.

Sir William and Lady Crookes celebrated their golden wedding last Tuesday, when they were "At Home" to a considerable company at the Empress Rooms, Kensington. Sir William Crookes, who was born in 1832, entered the College of Chemistry in 1848, and gained the Ashburton Scholarship the next year. In 1875 he produced the radiometer. He was President of the British Association in 1898, and received the Albert Medal of the Society of Arts in 1899. He is Proprietor and Editor of the "Chemical News."

By the death of Mr. George Coward, which took place on the 7th inst., the Gas Department of the Birkenhead Corporation have lost an old and valued servant. Deceased, who was 65 years of age, went to Birkenhead, after ten years' service with the Liverpool Gas Company, in 1864, under the Improvement Commissioners, and in 1881 was appointed Foreman of the Gas-Fittings Department. He was highly respected by all with whom he came in contact; and his funeral, which took place last Tuesday, was attended by representatives of all sections of the Gas Department, who were joined by numerous friends from the church in which for 21 years he had held office.

A paper on "Coal and What We Get from It," was read by Mr. G. H. Gemmell, Lecturer in Chemistry, of Edinburgh, to the Edinburgh Association of Science and Art on Monday last week. He said the ideal system of utilizing the energy in coal was to convert it into gas at the pit's mouth, and convey it in pipes to consumers for use in gas-engines. All cooking and heating would be done by gas, soot and smoke would disappear, and the 2 million tons of sulphuric acid, and 250 tons of soot, which were discharged into the air, would be saved for useful purposes. The author described the manufacture of coal gas, and the working up of the residuals, including coal tar and sulphate of ammonia. The value of the latter product recovered in gas-works was, he said, £2,500,000 a year; but if the ammonia from all the coal consumed were saved, it would have an annual value of £36,000,000. The preparation of aniline dyes from coal tar was described and illustrated by experiments.

THE GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 193.)

A WEEK of only four working days, with a holiday interval at the finish, was not calculated to be productive of business at high pressure. And seeing that it was, moreover, settlement week, fresh business was naturally kept down. But somehow or other, in spite of these repressive influences, the general tone was not so bad, even when, after the conclusion of the settlement, there seemed to be a general exodus to revel in the sunshine. For in the almost deserted markets, the tendency, wherever there was any perceptible, was cheerful still. The augury for the re-opening is good, especially as Parliament will not be sitting. In the Money Market, there was a fair demand. But the supply was ample to meet it, and more than meet it; so that towards the close it was not easy to place money. Discount rates held pretty stiff for some time; but they relaxed at the end. Business in the Gas Market was quite on a holiday scale—no single day being able to make up an average show. But short and quiet as the week was, a considerable number of quotations improved upon their old figures—some of them materially. In Gaslight and Coke issues, the ordinary was very moderately dealt in every day at prices which from first to last tended to harden. The opening transaction was at 98; but this was soon left behind, and 99 was marked on Wednesday and Thursday. But the quotation was left unchanged. A little business was done in the secured issues. The maximum changed hands at 88½; the preference at 109 and 110¼ (representing a rise of 1 in the quotation); and the debenture at from 89½ to 90. South Metropolitan was quiet and very steady; and transactions ranged from 128 to 128¾. In Commercials, there were a few dealings in the 4 per cent. at from 114¾ to 115¼; in the 3½ per cent. at 112 and 112½; and in the debenture at 87 (a rise of 1 in the quotation). Among the Suburban and Provincial group, Bournemouth "B" marked 17, Brentford old 264 and 266 (a rise of 1), and West Ham preference 124. Brentford new and debenture, and both Bromley issues, improved their quotations. In the Continental Companies, Imperial changed hands at from 234 to 235⅞ (a rise of 3); and ditto debenture at 96½. Union ordinary was done at 131; and ditto preference at 147. Among the undertakings of the remoter world, Bombay was done at 6⅞ special, ditto part-paid at 5¼, Cape Town debenture stock at 101¾, Buenos Ayres at 12⅞, Monte Video at 12¼, Primitiva ordinary at 7 15/16, ditto preference at 5 15/16, ditto debenture at 99¼, and River Plate at 13½ and 13¾.

The closing prices are shown in our Stock and Share List on page 193.

ELECTRIC LIGHTING MEMORANDA.

A Chairman of an Electricity Committee on a Sound Financial Policy—Surpluses and Depreciation—The Useful Life of Incandescent Electric Lamps—Public Lighting Question at Hastings—The Cost of Installing the "Oriflamme" Lamp.

SOUND sense permeates an article that Alderman Ewing Matheson, the Chairman of the Leeds Corporation Electricity Committee, contributes to the columns of the "Municipal Journal;" and a better medium for the dissemination of his views does not exist, for the paper in question is run entirely in the interests of that progressive municipalism which would bring under the control of local government, for profits' sake, as many forms of trading as can be filched from private enterprise. Alderman Matheson has the history of the Leeds Corporation electricity undertaking at his fingers' ends; and he uses his knowledge to write upon, and illustrate, the necessity for adequate depreciation in a manner that should assist in convincing the municipal "profit" grabbers of the error of their ways in not taking forethought in dealing with their finances. We shall endeavour to bring into this reference the principal points of the article.

Under powers conferred upon the Auditor appointed by the Board of Trade in the days of the old Yorkshire House-to-House Company (whose property was subsequently purchased by the Leeds Corporation), that official fixed a scale of depreciation based on the capital expenditure, which scale worked out to an average of 2·43 per cent. (in the final period of the Company's operations) on the entire capital expenditure. The Directors formed the opinion that the stipulated rate of depreciation was not adequate to balance the lessening value, and that a fund for renewal was necessary. In consequence of this, a reserve fund was set aside, which amounted at the close of the Company's operations to £8000. The need for this reserve has been more than justified by subsequent events. The transfer to the Corporation took place in 1898. These are particulars from the preface of the article, which is followed by a clear exposition of the differences existing between the capital of a municipal and a private undertaking. In most cases, seeing that the sinking fund charges of the former absorb so great a proportion of the gross receipts, only a small margin is left either for repairs or for reduction in price; and therefore the greater the reason for exercising prevision in framing the financial policy. The provision for renewals, under such circumstances, becomes a very serious

matter for consideration. Minor repairs are always going on, and can be defrayed out of the current receipts. But there are those more important renewals which only occur at intervals, and to meet them funds must be accumulated, if future burdens are to be avoided. In the case of the Leeds Corporation undertaking, the power to provide an adequate reserve fund has unfortunately not been utilized; and the application of the term "profits" to the surplus in early years has, as is the case in so many electricity undertakings, formed a most unfortunate precedent for all later years.

The Alderman argues seriously and with much weight on the unsoundness of the policy of giving away in relief of the rates an apparent or temporary surplus of gross income of any particular year which is available for, and ought to be set aside as, a reserve —especially when expensive renewals are already in sight. The temptation to treat as profit the surplus of income over expenditure, without sufficient provision for future contingencies, appears to be irresistible all too frequently. We all know how those who have the controlling of municipal undertakings, where the method of depreciating or forming a reserve is not adopted, put forward as their justification for treating the surplus as profit that, while the sinking fund provides for the redemption of the capital in a limited number of years, all renewals as they occur will be paid for out of revenue. Alderman Matheson, in his wisdom, will not have this. If a proportionate amount of renewals occurred every year, then it might be possible to expend the necessary amount so far as the surplus allowed, instead of treating it as profit. But as the expenditure occurs at uncertain times, no opportunity is afforded of providing for it if the surplus be absorbed at every annual account. The fallacy of looking upon the Local Government Board as a beneficent entity whose decision as to the length of the sinking fund period relieves the ratepayers and their representatives of all responsibility, is commented upon. Those whose circumstances are not propitious to a short or fair term for the repayment of their borrowings, are those who generally seek for long terms. Obviously, the longer the term, the lighter the immediate annual burden on the ratepayers or undertaking. But the total sum to be repaid is greater; and it is indeed difficult to understand why those who have the interest of their city or town at heart should, for present benefits (if so they can always be termed), desire to postpone the repayment to a future generation. As Alderman Matheson urges, calculations for depreciation are almost always difficult—there being seldom precedents available which afford safe guidance—and when, as in many cases, they are based on the mere estimate of physical wear and tear, they are fallacious. The risk of plant becoming obsolete and unable to compete with more appropriate plant, has ever to be considered. The accrued experience of the Local Government Board shows the insufficiency of past provision. This has been made manifest in recent years in our references to proceedings on Parliamentary Bills and at loan inquiries by the Board. The whole tendency now is to stiffen the conditions of borrowing powers. Upon such considerations as these, the Alderman holds that, while it may be undesirable to provide out of the rates for depreciation beyond the sinking fund, yet until it has been proved, by the experience of some years, that the sinking fund is sufficient for the double purpose, no temporary surplus should be deemed profit available for distribution. In municipal undertakings, the premature withdrawal of so-called profits from a manufacturing department, instead of allowing them to accumulate as a reserve, simply means that the future ratepayers will have to repay, in some form or other, the money thus erroneously distributed for the enjoyment of the ratepayers of to-day, or to continue using an obsolete plant. In the case, however, of the Leeds Corporation electricity undertaking, revenue and current expenditure are now so closely balanced, that only by an accumulation of small surpluses can important renewals be paid for. We wish there were more chairmen of town electricity committees who entertained the sound financial principles that Alderman Matheson enunciates. If there were, less would be heard of the indiscretions of municipalities, committed in courting a present and short-lived popularity.

The assumption of electricians as to the rapid deterioration of incandescent gas mantles supplies them so constantly, for lack of something more substantial and real, with a point for feeble gibe, that we should be more than human if resistance could be given to the oft-recurring opportunity for scoring off them, from their own testimony, as to the recession from the best—and the best is poor—light-giving value of ordinary commercial carbon filament lamps. Mr. Lancelot W. Wild is the contributor of an article to the "Electrical Review," in which he lays down the proposition that, owing to the deterioration of the illuminating value that takes place, almost from the commencement of the life of an incandescent lamp, it would pay to scrap lamps *at a very early age, were it not for the cost of renewals*. Mr. Wild has carried out a set of life-tests on 48 200-volt 16-candle lamps of twelve different makes (not selected, but bought over the counter); four lamps of each make being taken. The lamps were run at a mean pressure of 200 volts, but were subject to the ordinary range of variation of voltage found on the Westminster Electric Supply Corporation's circuits. It may be taken, therefore, that the average of all these 48 lamps represents fairly accurately a 200-volt 16-candle power lamp of average quality, working under average conditions. We have been taken to task on former occasions for making calculations as to the consumption of carbon filament lamps on the basis of 4 watts per candle power. Let us see what confirmation of our action can be obtained from Mr. Wild's tests. They show that, at the commencement, an illuminating power of 16·7 candles was obtained; the consumption being equal to 3·58 watts per candle; at 100 hours, the illuminating power was 15·9 candles, the consumption 3·81 watts per candle; at 300 hours, 14·35 candles, and 4·13 watts per candle; at 600 hours, 12·65 candles, and 4·60 watts per candle; at 900 hours, 11·55 candles, and 5 watts per candle; and at 1000 hours, 11·3 candles, and 5·08 watts per candle. Therefore, 4 watts is a generous average; and in view of the cost of renewals, consumers are all too prone to get into wasteful consumptions before replacing their lamps. There are other tables in the article; the last one giving the total cost per candle-power-hour in pence. Placing the figures in the form of curves, it is seen that the correct scrapping points of these lamps, costing 10d. each, come out as follows: With electricity at 1d. per unit, the useful life may be taken as 1000 hours; at 2d., 650 hours; at 3d., 500 hours; at 4d., 450 hours; at 5d., 400 hours; and at 6d., 350 hours. Of course, these figures are intended to apply only to an average 200-volt 16-candle power unselected incandescent lamp, run under average working conditions, and costing 10d. per lamp. The useful life of a lamp is sometimes stated as the number of hours it runs before the candle-power drops 20 per cent. This occurs in the case of the average of the 48 lamps at 460 hours. It must be understood, too, that these are the tests of a skilled experimenter, and no doubt made under the benign conditions found in the laboratory.

Several of the members of the Hastings Town Council, at their first meeting in April, testified, in the strongest manner possible, that to them the interests of the electricity undertaking are of greater moment than those of the ratepayers. Mr. Cox had a motion on the *agenda* to instruct the Public Lighting Committee (afterwards altered to the Electric Lighting Committee) to report upon a scheme for the conversion of the existing electric arc lamps to the Oliver "Oriflamme" lamps. Directly Mr. Cox rose, there was an unseemly rush for the door; and when he had eventually been suppressed (the resolution, however, being carried probably as a convenient way of getting rid of it), the members trooped back again into the chamber. The fact of the matter is that Mr. Cox had been preparing a number of figures and facts intended to show that the street lighting by electricity is costing the ratepayers an unreasonable amount of money, and that the ratepayers, though paying so steeply, are getting an inferior illumination from the arc lamps. Therefore the putting in of more modern lamps is a thing that, in Mr. Cox's view, is greatly to be desired. Though this perhaps is a rational thing to do, the drain on the pockets of the ratepayers for current expenses is not, according to municipal wisdom, a matter for such great consideration as the exposure that would perhaps ensue from the investigation of a scheme for wholesale conversion—exposure of improvidence in the past, of loans for public lighting still unsatisfied but with lamps quite worn out, and upon undischarged loans further heavy capital expenditure required for modernization. Our progressive corporator is thin-skinned; and he will pay any price—out of the ratepayers' private purses —to hide his extravagance in the management of the town's affairs. We can only assume that the strange behaviour towards Mr. Cox was a protest against the opportunity he was giving for publishing figures as to the prodigal cost of public lighting by electricity. The cost of lighting a few miles of streets in Hastings by electric arcs was £4198 19s. 7d. in 1904, or upwards of £40 per lamp! It is asserted that the Electricity Department have been making very little profit on this abominable piece of extravagance; but this we cannot believe, unless their works' costs are inordinately high. If they are not getting any advantage out of the public lighting, then why should the ratepayers be asked to pay such a price for each point of what is asserted to be very bad lighting? Town Councillors whose notions of good manners permit them to unite in the contemptuous treatment of a colleague, can hardly be expected to apply themselves to the logical consideration of the foregoing question.

We cannot follow all the figures advanced by Mr. Cox in support of his motion for conversion; but it does not matter much, as estimates in which electric lighting is concerned have a habit of never receiving justification in the event. In another part of the proceedings of the Hastings Council on the same day, some light was thrown on the question of the cost of converting gas-lamps to the Oliver "Oriflamme" system of lighting, notwithstanding that a liberal use is proposed to be made of the tramway standards to save expense. But even so, the cost of putting up 21 of these Oliver lamps, for the lighting of some short lengths of thoroughfares—Queen's, Cambridge, and Bohemia Roads—is calculated at £472 10s., which works out at £22 10s. apiece. But beyond this, £100 is to be expended on putting in the service-lines. It is estimated that ten years will be allowed for repayment of the capital involved; but the Oliver people only guarantee the lamps for three years. We do not see that in the estimates any allowance is made for wear and tear; but, of course, it does not suit the book of the Electric Lighting Committee to divulge to the ratepayers the fact that the depreciation of lamps of the flame type goes on, according to present experience, at a much more rapid rate than is the case with the old form of arc lamp; and looking at some of the pretty specimens in several parts of London (we will except the City, so as to please our electrical friends), the depreciation of the latter proceeds quite rapidly enough. Twenty of these Oliver lamps are to displace 46 gas-lamps; and including the repayment of the £472 in ten years, but not the £100 for

services, the cost (also excluding, so far as can be seen, the wear and tear) is going to be £100 more per annum. The Electric Lighting Committee have offered to supply the new lamps at £10 a year each, which is a great drop from the £40 and over that has been paid by the ratepayers for the old arc lamps. Well, now, is this £10 a sporting offer just for the sake of the advertisement, or have the Electric Lighting Committee been robbing the ratepayers through the public lighting by their old charges? The ratepayers should demand an explanation; for we do not think the £10 a year will nearly pay the department. It is stated that the "Oriflamme" lamps are to have an illuminating power of 2000 candles. Before giving credence to this rating, we should prefer to know something about how the candle power was arrived at; and if the lamps are, in fact, of 2000 candles, when "new" (as the electrical papers are fond of saying with regard to incandescent gas mantles), it would be interesting to know what the Queen's, Cambridge, and Bohemia Roads can really be wanting with a few centres of light of such great intensity. The Corporation have a year-book, from which the ratepayers can no doubt learn that, for a number of miles of streets not running into two figures, they have been paying for electric lighting nearly as much as they have been doing for lighting by gas a number of miles of streets running into nearly three figures. Can it be marvelled at that the Ratepayers' Association want the Corporation to pause before going in further for public electric lighting; and, as the electric undertaking is a Corporation venture which showed the remarkable surplus of £117 in 1904, is it to be wondered at that a majority of the Council did not want to pause?

OHIO QUESTION-BOX.

Manufacturing Operation and Residuals.

Confirmation of the previously expressed opinion that in some cases the classification of the questions in the volume under review is faulty, is found immediately on turning attention to the section dealing with "Manufacturing Operation." Criticism, all must find, helps to perfection. The opening question is, "What is the best and most economical way to use oil in a coal-gas bench where the demand is greater than the capacity for about four or five days in a month?" We cannot see why this question and the first one in the "Gas Making Material" section—"Has anyone tried using about ½ gallon or less of crude oil on the coal just before throwing into the retort?"—should not have been placed together. It is so much more convenient to get a grouping which permits of ready reference. We will not deal with the answers to the question, as though they may quite correctly show the most economical way of using oil in a coal-gas bench, the works must be insignificant ones that find the system economical for supplementing output; and enrichment on this side of the Atlantic is beginning to be looked upon as of historical interest only. The use of tar for boiler fuel has not been taken up in this country to any great extent; but still there is interest in the replies which are given to the inquiry, "Which is the more economical fuel for boilers—tar at 5 cents per gallon, or coal at $3·48 per ton?" Needless to say, opinions differ; some correspondents proving their contention to their own satisfaction by money, others by heat units. Tar at 5 cents is the most economical, says one; "take the 5 cents," in effect advises another, "if that price can be obtained." Properly consumed, a contributor asserts, one gallon of tar is equal to 100 lbs. of coal—tar 20 × 5 c. = $1; coal 20 × 17·4 c. = $3·48. Another correspondent endeavours to prove that tar and coal are of about equal value for the purpose. But, on the whole, at the prices named, coal is generally advocated. As examples: Tar, says a correspondent, has a fuel value of about 2½ cents per gallon, as compared with coal at $3·48 per ton. Another observes: "Coal is cheaper by far. The equivalent evaporation per ton of tar (194 gallons) = 16,000 lbs. The equivalent evaporation per ton of coal = 12,000 lbs. Cost of tar at 5 cents per gallon = $9·70 per ton. Cost of sufficient coal at $3·48 to evaporate same amount of water as tar, $4·64. Difference in favour of coal, $5·06 per ton"—less, of course, the value of the difference in evaporative power.

If three men out of four is the proportion of gas managers in Ohio who think that producer plants are the most economical means of generating gas for power-plant use, then the power business must for the ordinary gas distributor be in a bad way there. Of course, the answer to the question must depend upon the all-important factor of the cost of ordinary gas production. The writer who epigrammatically answers the inquiry with "producer plants" must be a gentleman of decided view on the subject. The succeeding correspondent explains that the most economical method of generating power gas is undoubtedly the usual type of producer plant operating on anthracite pea coal. Under these conditions, a minimum amount of labour is required; while the resulting gas is of a fairly constant analysis. The coal consumption will vary between 1 lb. and 1¼ lbs. of anthracite pea coal per brake-horse-power per hour. The answer of another correspondent is "a suction producer, using anthracite coal, coke, lignite, or charcoal, possibly with the addition of some oil." There is only one advocate for coal gas who says: "For a small power plant, if you have works, make coal gas for your gas-engine." Quite a big capture of correspondents was made by the question: "Will oxide once saturated by tar again become active by long exposure to air and frequent turning?" It is correct to say that, with but one or two exceptions, the replies are in the negative. If given long exposure, it may partially, certain contributors say, regain activity, but only to a very small extent. A reply by Mr. Norton H. Humphrys reflects the views of others. It is that if the oxide is saturated to an extent sufficient to really clog the material and destroy its porous nature—on which the purifying efficiency depends—no amount of exposure or turning will render it active again. But there are a couple of correspondents who offer remedies. One advises that oxide so saturated can be revivified almost as good as new if subjected to frequent turning and occasional sprinkling with hot water and copperas. Another confident gentleman suggests exposure to the sun, but not to allow the material to become too dry.

Inquiry succeeds this question as to the depth that soft coal may be piled with safety without providing ventilation. A depth of 12 to 16 feet is the general experience of the contributors of answers. One correspondent, however, has seen coal piled at the mine without covering for six months, 100 ft. by 300 ft. by 20 ft. deep; and the coal did not heat. But doubts arise as to any common rule, when it is seen that a correspondent once had a fire start in a pile of gas coal that was not over 3 feet deep; but, of course, it depends largely on the condition of the coal. If it is dry, not freshly mined, free from pyrites, not finely broken, and under cover, the depths first mentioned are generally considered to be safe. We get back again to the question of oil; experiences being invited as to the removal of oil from gas made of crude oil before the gas reaches the oxide, and forms a deposit there. The passing of the gas through a vessel containing shavings or ground corncobs is recommended; this being regarded as less detrimental to the candle power than the process of washing. But washing, on the other hand, is the very thing that is believed to be efficacious by another correspondent, who advocates slow speed in condensing and scrubbing apparatus and thorough washing. Mr. C. F. Botley supplies an account of the English practice, using American gas oil in a modified Lowe set. The following improvements have been made in the plant under his charge, with the object of preventing the deposition of oil in the oxide purifiers: "(1) An improved carburettor, where the oil is introduced in the form of fog or mist, resulting in the production of a more uniform and permanent gas. (2) Frictional condensation after the water-tube condenser, and before the relief holder. This takes the form of a horizontal pipe condenser. (3) Packing the space below the bottom row of sieves or grids with hard coke, with occasional changes of the coke."

There is really little variety of opinion, though differently expressed, in a large batch of replies to the inquiry, as to whether, when a 60,000 cubic feet gasholder is nearly full, the pressure is greater at the outlet-pipe than when it contains but 2000 cubic feet. Mr. N. H. Humphrys is among the contributors with an answer which is in agreement with many others. He states that the pressure given by a gasholder increases as it rises, according to the cubic contents of the parts immersed. When the holder is full, the floating weight is greater than when it is empty, to an extent represented by the displacement of the water. When the vessel is empty, the whole of the sides are immersed; when it is full, only about 6 inches of the height. The holder may be 60 feet in diameter and rise 25 feet, with an average thickness of the sides of ⅛ inch. Then each foot rise will represent approximately 2 cubic feet, and the weight of the bulk of the water is 125 lbs. The floating weight when full will, therefore, be 125 × 24½, or about 27 cwt. greater than when empty; and this weight would represent about 2-10ths pressure. The outlet pressure would therefore be 2-10ths more when the holder is full than when it is empty.

A later question seeks to elicit information as to whether any bad results are likely to follow from the mixing of coal and carburetted water gas before either gas has been washed or purified, provided the water gas has first been cooled in a relief holder. There are only three contributors to this question, two of whom have not experienced any bad results; but the third asserts that such a system of operation throws more work upon the purifiers, owing to the greater amount of carbonic acid in the water gas, which will break up the unstable sulphur compound of ammonium in the washers and scrubbers, and evolve sulphuretted hydrogen. Having thus disposed of this point in a manner that still leaves the inquirer in doubt, rather more agreement is discovered in the consideration given to the inquiry as to what are good results on oil in water-gas plants expressed in candles per gallon. Taking 6 to 7½ candles per gallon, we have the figures between which the majority of the correspondents range. Of course, the figures are, as Mr. C. F. Botley points out, affected by the description of oil employed, the position where the illuminating power is taken in relation to the plant, and the method used for testing the illuminating power. His experience leads him to the conclusion that 6½ candles per gallon is a good average result, 7 candles is distinctly good, and 7½ candles exceptionally so. From the answers to a subsequent question, it is learnt that there are positive savings to be effected by preheating oil used in a water-gas set. One correspondent mentions a saving of $\frac{1}{10}$ gallon per 1000 cubic feet by using exhaust steam for heating.

A question which will interest Mr. R. G. Shadbolt is intended to elicit information as to whether anyone in America has made experiments to determine the effect of diluting coal gas by the addition of producer gas taken directly from the furnace of the

retort-bench. Only one correspondent confesses to experience, though no doubt others could, if they so chose, confirm his. His experience in this direction was, as is that of most other engineers, involuntarily gained. The results were disastrous to the illuminating power; and for some reason there was a sudden increase of stopped ascension-pipes. Being accidental, of course there was no opportunity for selection or regulation.

The number of questions in this section of "Manufacturing Operation" is large; but from them we can select only one other for notice. We make reference in the early part of this article to an inquiry regarding suction gas and other producer-gas plants. After wading through about fifty questions on other subjects, a similar one is found; and a new complexion is put upon the subject. It appears from this further group of replies that the contributors are not of opinion that the small sizes of producer plant are economical. One correspondent asserts that, if the question of the initial cost of the plant was left out of consideration, then suction-gas producers with gas-engines could be operated down to quite small sizes. In this writer's investigation, he has found the greatest difficulty in the first cost, and believes the smallest size, from the standpoints of initial cost and operating economy, should be not smaller than 75-horse power—he prefers, indeed, to say 100-horse power. There are producers on the market for smaller sizes at what seem to be moderate prices; but he finds that their powers are very much over-rated. The great trouble with the small sizes is that the gas-engine for producer gas should be specially designed; and so far the best gas-engine makers of America have mainly confined themselves to the larger sizes—from 50-horse power upwards. Small gas-producers will necessarily be confined to the suction type, and can be operated in small sizes at extreme economy with a properly designed engine; but at present, he says, the interest on the initial investment will offset the economy in the small sizes. Also, be it remembered, speaking of American conditions, another contributor remarks that the smallest size producer which it is economical to instal depends largely on the cost of fuel and labour in the locality. With coal at $3 per ton, or less, a gas-producer plant of 25-horse power or over would show a fair economy in competition with illuminating gas for the operation of the same engine. On smaller sizes, however, the labour item for a man to take care of the engine and producer would offset the saving of fuel. The writer calculates that the smallest producer plant it is desirable to instal is one for a maximum rating of 50-horse power, in which case the average load would be found to be 35-horse power in practice. Should, however, the load be intermittent and of a smaller figure, the city-gas driven engines would be more advantageous and economical.

There is not a great deal in the "Residuals" section of the volume with which we desire to deal; and, in fact, only two or three of the inquiries will be brought under notice here. There is one which has for its object the procuring of information as to which is the best way to take care of coke so as to avoid re-handling to get it without breeze. To get coke without breeze is rather a tall order; and there are gas engineers who, if they can effect savings in other ways, are not averse to doing so at the expense of obtaining a little additional breeze. One correspondent deals with the inquiry very fully; and the only other one briefly. The latter advocates conveying the coke to bins, with hopper bottoms for loading purposes. The former states that the best and cheapest way of handling coke is an inclined hopper under the operating-floor, in which hopper the coke rests after it is drawn from the retorts. To the hopper is connected a blower. As the coke falls on the incline, it is sprayed with water and the blower is started. The water and sulphur vapours arising from the quenching are drawn out of the hopper by the blower, thus removing the obnoxious gases from the retort-house, and eliminating a great nuisance, some danger, and also the corrosion of the iron floor-beams. After the coke is quenched, the spray is stopped and the blower allowed to run a few minutes, which has a tendency to dry the coke. The doors of the hopper are then opened, and the coke pulled into buggies, deposited on an elevator, and then dumped on to screen bars—the coke rolling down and sorting itself by gravity. From among further questions relating to coke, it is found that the opinion exists that 30,000 tons of coke will practically wear out the fluted rolls, hopper, belt, and revolving screen of a "domestic" coke plant. Toothed rolls, it is asserted, will not crush more than 10,000 tons. Depreciation for crushing and screening coke should be from ¼c. to ½c. per bushel. The depreciation per bushel for crushing and sorting coke, including wear and tear on hopper, conveyor belts, screen, and planking, is put by another correspondent at 1 per cent.

The manufacture of sulphate of ammonia is not, apparently, largely practised in American gas-works. From answers to a question dealing with this matter, it is gathered that in 1903 the ammonia produced by the gas-works and bye-product coke-oven plants in the United States was 79,800,000 lbs., calculated as sulphate of ammonia, and was worth nearly $1,750,000. Besides this, 33,500,000 lbs. of sulphate of ammonia were imported; making a total of 113,300,000 lbs. But succeeding this information, is a statement which assures the reader that sulphate of ammonia is manufactured in the States "almost exclusively" by bye-product coke-oven establishments. Indeed, so far as known, only two gas companies are still making sulphate. American gas-coals, it is stated, yield less ammonia than English; but this is believed to be largely due to the lower carbonizing heats employed.

RAILWAY COMPANIES AND THEIR POWERS TO OBTAIN WATER.

The prompt action taken by the Sutton District Water Company to restrain the London, Brighton, and South Coast Railway Company from tapping sources of water in the neighbourhood of the River Wandle, and conveying water along their line for the service of the Victoria Terminus and the intermediate electric power station (to which attention was recently called in our "Parliamentary Intelligence"), has had good results. The second reading of the Brighton Company's Bill had been blocked, so as to allow of this unusual proceeding on the part of a railway company being brought under the notice of the House; but it was permitted to pass this stage on the promoters at length giving way on this and on some other points objected to. Mr. Barnard, the Member for Kidderminster, said that he understood the Company were prepared to bind themselves not to use the water in question outside the district in which it was raised; and on receiving an assurance from the Secretary to the Board of Trade that this condition would be properly formulated, he would be prepared to withdraw his opposition to the Bill. The measure accordingly went before a Select Committee—relieved to this extent, but by no means unopposed. However, it passed through the investigation, and has been reported.

Meanwhile, the Water Company have presented their petition for permission to introduce their Bill, the scope of which has already been indicated, and it has been granted by the Standing Orders Committee. The Company are supported in their action by the Carshalton Urban District Council and the Provincial Water Companies' Association (which bodies, with some others, have already petitioned in favour of the Bill), as well as by the River Wandle Protection Association, the members of which are representatives of the many large manufacturing and milling firms whose works stand on the banks of the river. The Company's reason for proceeding with the Bill in face of an undertaking given by the Railway Company not to use the water beyond a radius of six miles from the spot where it is raised, is to be found in the fact that they have from the first declined to accept it. They naturally consider that the Railway Company should not be allowed to do what the authorized water suppliers for the district, who have the responsibility of providing for the requirements of ten growing parishes, are absolutely prohibited from doing; for in 1887 the Company were compelled to accept a clause forbidding them to sink wells on their own land without the sanction of Parliament.

Why, it might fairly be asked, were the Sutton Company thus restricted, were it not to conserve the sources of water in the district in the general interests of the local manufacturers and others who were relying upon them for carrying on their operations? The chalk areas in Surrey were for a long time regarded as a possible source for increasing the water supply of the Metropolis; and during the long investigation that was conducted by Lord Balfour in 1892-3, both Mr. Baldwin Latham and Mr. Whitaker expressed the opinion that the quantity then being obtained might be greatly increased. The Commissioners therefore came to the conclusion that, taking the entire chalk area traversed by the Mole and the Wandle, the subterranean water supply was not then being drawn upon to its full capacity. But they nevertheless thought that any serious pumping in the neighbourhood of the latter river would diminish its flow. What the effect of such diminution would be on the industries depending upon the volume of the stream—to say nothing of the Water Company more especially concerned—may be readily imagined. It would be simply disastrous. But acknowledging that the Railway Company have a legal right to sink a well upon their own land, it is questionable whether, without parliamentary authority, they can convey the water drawn therefrom for use at a place fourteen miles distant. In view of the way in which the sources of water in the district, especially in the watershed of the Wandle, have hitherto been protected from the encroachments of outsiders, and the amount of local support which is being given to the Water Company, we doubt whether any such authority will be granted. As Mr. Vaux Graham, the Consulting Engineer to the Company, has pointed out, Parliament would not be likely to give in this case powers which, in the general interests of the district, had been denied to others. To do so would be to establish a precedent of which other railway companies in the country might take advantage, to the injury of local suppliers of water. He and his Company have done good service in directing the attention of Parliament and the public to this matter, and the Provincial Water Companies' Association in supporting them in the action they have undertaken.

It is stated that the process of changing the lighting installation at the Cumbrae Lighthouse from electricity to acetylene will be completed in about two months' time. Acetylene has been in operation for some time at the Cloch Lighthouse, and it appears has worked very satisfactorily. The "Engineer" says the change is being made at the Cumbrae Lighthouse from motives of efficiency, and not entirely of economy, for acetylene has been found to give a better fog light, besides being cheaper and more easily worked, than electricity.

CHARGING AND DISCHARGING MACHINERY AT THE LONGWOOD GAS-WORKS.

At the end of last year, the Longwood Gas Company, on the advice of their Engineer (Mr. J. H. Brearley), gave an order for a complete coal-handling plant—charging and discharging machines, including generating plant—to Messrs. R. Dempster and Sons, Limited, of Elland, of a similar character to the machines already described in the "JOURNAL," as having been erected at the new gas-works of the Falkirk Corporation. The apparatus at Longwood has now been put into successful operation; and the accompanying illustrations are photographs of the machines taken in the Contractors' works, prior to being forwarded to Longwood.

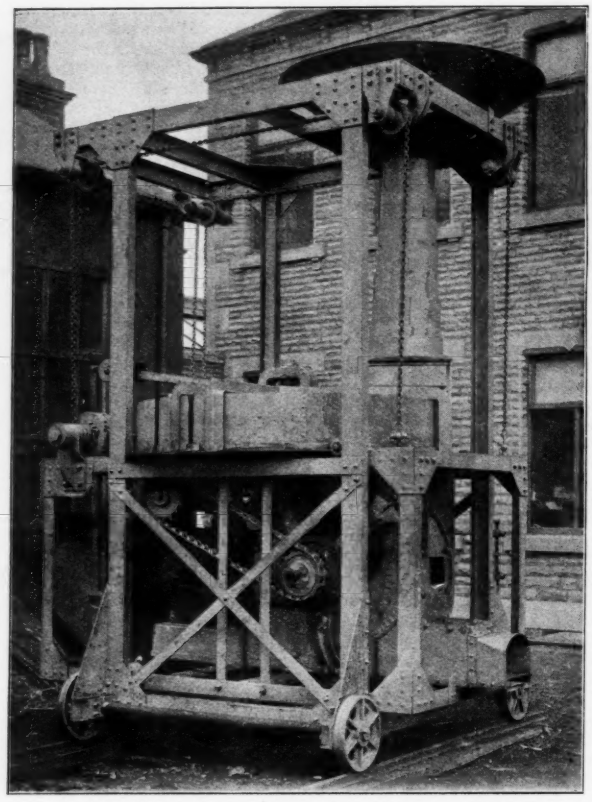


Fig. 1.—Toogood's Patent Charging Machine, Fitted with Shallow-Depth Measuring Chamber.

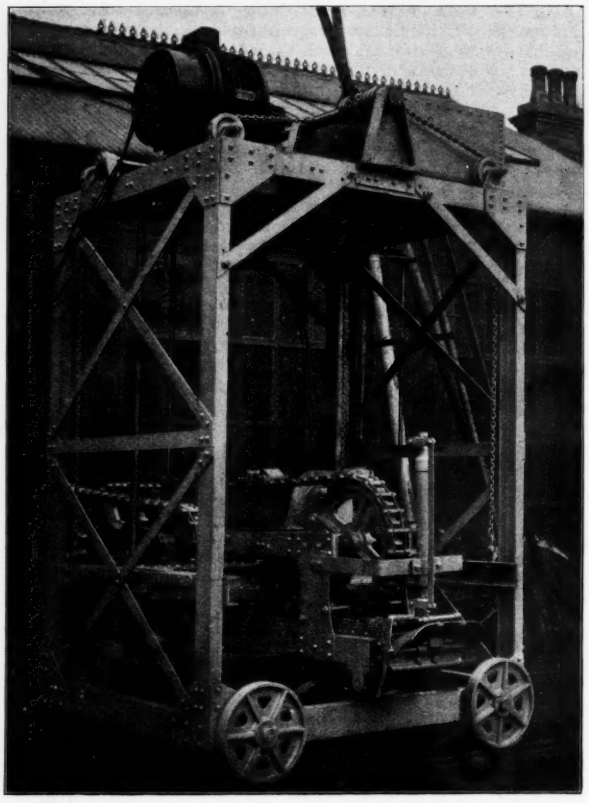


Fig. 3.—Dempster and Milton's Patent Discharging Machine, showing the Ram Withdrawn.

The charging machine is illustrated in fig. 1. It is like the Falkirk machine, except that it is not provided with a large overhead hopper, and is fitted with a new patent revolving circular measuring chamber, as shown in fig. 2. This chamber is 6 feet diameter, and has a maximum depth of 12 inches. It is fitted with an inner ring 3 ft. 6 in. in diameter. In the annular space between the outer and inner ring are connecting plates, forming pockets, which act as scrapers also. These pockets are filled with coal by means of a telescopic shoot from the overhead continuous storage hopper. The depth of coal in the feed chamber can be adjusted so as to obtain the desired weight of coal. Half a revolution of the chamber completes a charge for a 10-feet retort, and a complete revolution for a 20-feet retort. The measuring chamber automatically stops when the charge is completed. In the chamber, the coal is carried round in a circular manner over a stationary bottom plate, by means of the scraper-plates already referred to. In the bottom plate is a hole, through which the coal falls into the charging machine, without any risk of either choking or over-feeding the machine. The Longwood retort-house is fitted with continuous overhead hoppers of over 24 hours' capacity; taking the maximum daily quantity of coal used. Only a small portion of this overhead storage could have been obtained if measuring chambers, as is usually the case, had been adopted. This will at once be seen when it is pointed out that the height from the rail-level to the roof principal is only 16 ft. 6 in. The machine puts perfectly level charges into the retorts, without causing any nuisance from flame, dust, or smoke, which the makers claim to be an important feature of their "Toogood" charging machine.

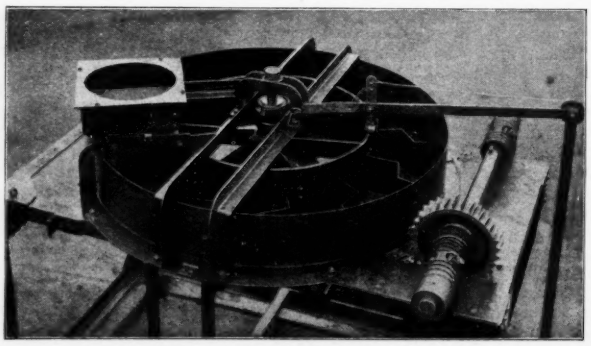


Fig. 2.—Inside View of Dempster and Milton's Patent Shallow-Depth Measuring Chamber, as Fitted to the Longwood Charging Machine.

Fig. 3 shows the discharging machine, with the dischargers home; and fig. 4, with them extended. This machine is different in construction to the one at Falkirk. At Longwood, the width from the face of the mouthpiece to the retort-house wall is only 13 ft. 6 in.; and there was therefore not enough room to instal the telescopic tube discharger, as in use at Falkirk. In conjunction with their Mr. Mitton, Messrs. Dempster and Sons designed a new machine to suit the exigencies of the situation. This machine consists of a tube for the first length; but this tube can be substituted by tee steel, flat bars, or other suitable section. The second and third lengths consist of U-shaped troughs; the whole being filled with water. One of the novel features of this discharging machine is the method of operating the ram by means of an endless chain running over sprocket wheels attached to the frame of the machine, which endless chain is fitted with suitable shoes or projections to engage with corresponding projections fitted to each length of the ram. By this arrangement, which works perfectly, no chain or other driving gear enters the retort; and the makers claim that this type of discharger reduces wear and tear to a minimum. The ram automatically stops at the end of the outward or return stroke by both the electric current being cut off and by the clutch driving the gearing being simultaneously thrown out of gear. The machine also draws coke out of stop-ended retorts, as has been tested by actual work at Longwood.

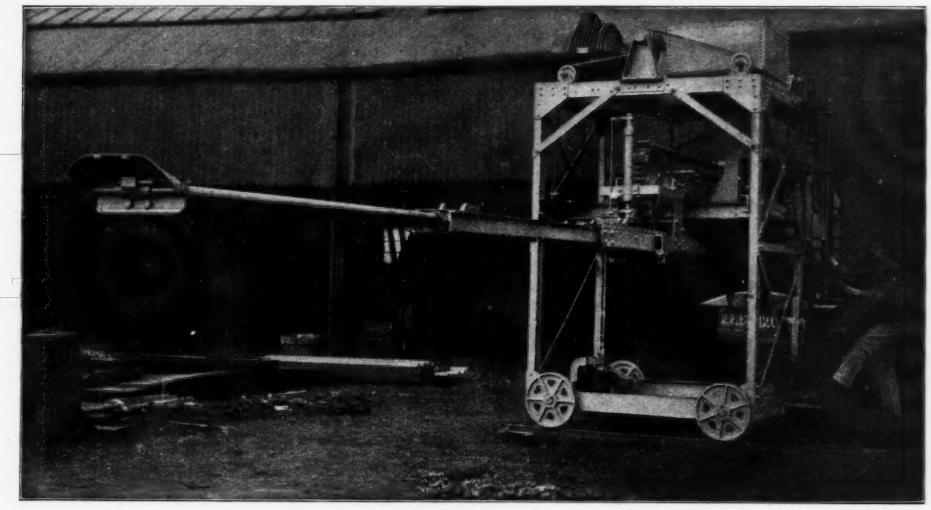


Fig. 4.—Dempster and Milton's Patent Discharger with the Ram Extended to Clear a 20-Feet Retort.

Gas companies having either single or back-ended retorts can therefore now have the full benefit of this type of charging and discharging machinery.

We understand that Messrs. Dempster and Sons have secured the contract for similar machinery for the Bingley Urban District Council, after the Gas Committee had paid a visit to Falkirk, and inspected the machines in actual operation. The Falkirk new works are now being closed down to enable them to be completed; and they will be restarted at the beginning of the new financial year—the middle of next month. It is stated that the Falkirk charging machine has worked practically without a hitch for over three months, giving complete satisfaction. A close examination shows that there has been no visible wear and tear on the machine. The discharging machine, too, has, since completion, worked without a hitch, and to the satisfaction of all concerned. The Falkirk Gas-Works have already been visited by a large number of engineers, all of whom have expressed themselves highly pleased with the working of the machines.

VERTICAL RETORTS FOR THE PRODUCTION OF ILLUMINATING GAS.

By William Young, of Peebles.

[Fifth Article.]

Having shown how the heat transmitted through the walls of the Dessau retorts to the volatile constituents from the coal might be economically utilized on the counter-current principle—much as in the Young and Beilby retorts—with the addition of an empty section or free space for their gasification by radiant heat, it is next desirable to direct attention to the heat transmitted to, and left in, the coke or fixed carbon. We are told that, "at the time that Herr Körting forwarded his report, he was contemplating at once experimenting with the blowing of small quantities of steam into the retorts during the second half of the carbonization, and it is expected that this will have a beneficial influence on the production of ammonia."

Now, as has been explained, the experience gained in connection with the shale-oil industry shows that the increased yield of ammonia by the use of steam, is mainly obtained from the nitrogen left in the coke; and further that, in order to obtain this nitrogen in the coke as ammonia, it is necessary to use not a small quantity but a very large quantity of steam—an excess such as will produce a water gas containing a large percentage of carbonic acid. Besides, if the coked portion of the coal is so dense as to prevent the volatile products passing through it, but drives them inwards and upwards through the comparatively cold central core of coal, it is evident that any steam blown into the retorts during the second half of the carbonization, would take the same course, and would not therefore be brought into contact with the nitrogenous carbon of the coked portion.

These observations at once show the advantage of the Young and Beilby principle of dropping the highly-heated coke into a lower chamber, in which the dense coke would be loosened or broken up, and the heat which it contained could be economically utilized, on the counter-current principle, to heat up and decompose the steam—setting free a portion of the nitrogen as ammonia. The ammonia thus produced, together with the accompanying water gas and steam, would pass up through the core of uncarbonized coal at the lower temperature and the vacant space, and would not be decomposed.

As explained, the Dessau vertical retort has been selected as a convenient means of illustrating what Mr. Glover and the writer believe to be the fundamental principles on which coal should be carbonized in vertical retorts for the production of illuminating and heating gas with increased yield of ammonia. We do not, however, for reasons stated, consider it an effective method of applying these principles, and more particularly to the carbonizing of coal which softens and intumesces and forms a massive coke during the carbonizing process. Our experience in connection with the carbonizing of shales and coal for the production of liquid products and ammonia, and with the Peebles process for the gasification of such liquid products, convinces us that the best results in the gasification of the volatile hydrocarbonacious and nitrogenous constituents of the coal will be obtained by following as closely as possible (consistent, of course, with the difference between a solid and a liquid) the Peebles process—*i. e.*, feeding the coal into the retort in a continuous manner; so that the coal, in its passage through the retort, will be subjected to increasing temperature. In this way, the least stable volatilizable compounds will be destructively distilled out of the coal by heat of lower temperature, and the more stable compounds by heats of suitable gradually increasing temperature. Further, the temperature of the heat applied to the walls of the section of the retort in which these evolved products from the coal are selectively cracked and gasified by the action of radiant heat, shall be rather below than above that necessary to crack-up the vapours at a single passage. The portion which escapes gasification is not lost as tar, but is mainly condensed upon the inflowing coal, and returned to the retorts to be again volatilized and undergo further gasification.

The method of returning over again to the retort the ungasified liquid tarry oils, involves a small extra amount of fuel. That, however, is far more than compensated for by the increased volume and the better quality of the resulting gas, and the less risk of the decomposition of the ammonia.

The continuous feeding and dropping of the coal through the retort, during the carbonizing process, leave the resulting coke in a more porous and less massive condition, which allows of the water gas or steam, or the mixed water gas and steam, to pass up through and amongst the carbonizing and coked coal for the liberation of the nitrogen as ammonia.

These principles may be applied to the carbonization of coal for the production of gas with increased yields of ammonia, by various mechanical devices, the elements of which have been previously described and illustrated as applied to the carbonization of shale for oil and ammonia. My colleague, Mr. Samuel Glover, is at present engaged in the preparation of working drawings for a bench of retorts embodying what we believe to be the application of the best of these mechanical elements—modified, of course, to suit the difference in the character of the materials to be carbonized. These will be sent for publication in the "Journal," together with a description, on their completion.

From these (when sent) it will be seen that the construction of the retorts, the method of setting and heating, and the arrangement for introducing the steam and discharging the coke, are all substantially identical with the lower section of the retorts so

long successfully employed for the carbonization of shale for the production of oil and ammonia, and that the iron sections of the shale retorts are replaced by the hoppers for containing the coal, up through which the hot gasified products are made to pass to the collecting main, and from which the coal so heated is continuously fed into the retorts by devices also substantially identical with those used in the shale-oil industry. And, considering that by these retorts and devices many millions of tons of shale have been successfully and economically carbonized for the production of oil and ammonia, the experience so gained gives us confidence in believing that coal will be equally well carbonized for the production of gas, with an increased yield of ammonia, by these modified arrangements.

Meantime, however, it may be desirable to make a few remarks as to what are the advantages which past experience would lead us to expect to accrue from the carbonization of coal in vertical retorts, such as those used in the shale-oil industry, modified as suggested. With regard to constructional cost per ton of coal carbonized, I do not expect that there will be much difference from that of horizontal retorts with mechanical stoking or ordinary inclined retort-settings, with staging. But any difference there might be, would be in favour of the vertical retorts. To give those interested an idea of the relative costs, I may mention that the six benches of eighty retorts referred to as having been erected upon old foundations at the Hopetoun, Uphall, and Addiewell works of Young's Paraffin Light Company, Limited, cost on an average about £7500. The saving by building upon the old foundation would be about £500, making the cost of these benches of eighty retorts in all £8000.

Assuming that the upper cast-iron retorts, and the hopper of these retorts, are taken as equivalent to the feeding and measuring hoppers of the modified coal-gas retorts, and that the brickwork in the walls surrounding these retorts and hoppers in the shale retorts is taken as equivalent to the cost of the extra brickwork in forming the secondary-air regenerators in the division walls and that in the outside producer for the coal-gas retorts, the only extra cost to be considered would be that for the continuous storage hoppers the whole length of the bench, and the ironwork for the outside producer. This would certainly not exceed £2000. That rough, but I think fairly safe, estimate would make the cost of the bench of eighty retorts, such as we propose, to be £10,000. Assuming further that such a bench would carbonize 200 tons per 24 hours (which appears to me also a perfectly safe estimate), that would bring out the cost at £50 per ton of coal carbonized.

With regard to the cost of upkeep and renewal, my experience with vertical retorts in connection with the shale-oil industry would lead me to believe that such costs would be very much smaller with verticals than with either horizontal or inclined retorts. Further, these vertical retorts would occupy less ground area per 1000 cubic feet of gas produced than either inclined or horizontal retorts, unless they are set more than three tiers deep, in which case they are inconvenient to work.

The carbonizing costs for labour with modern mechanical appliances are now very small, both with horizontal and with inclined retorts; and I do not expect there would be much gain in this item by the adoption of vertical retorts—probably not more than 2d. or 3d. per ton.

Although, however, in these three respects—cost of renewal and upkeep, and saving in cost of labour—there may not be savings such as justify the leaving of present methods and adopting the proposed method of carbonizing coal, yet past experience justifies us in believing that the gains in other respects would be very considerable. As has been previously explained, prior to the introduction of the Young and Beilby system of retorting shale, the method of distilling the shale by what was known as downward distillation, was ideally perfect in principle, and produced the largest possible quantity of crude oil of the finest quality. The change in the principle of distilling the shale in vertical retorts upwards, was made solely with the object of increasing the yield of ammonia, and because the large quantity of steam that it was necessary to employ in order to obtain the ammonia could be most economically utilized on the counter-current principle.

Now, as has been already shown, existing methods of carbonizing coal for the production of gas and ammonia are by no means ideal. The conditions are such as to prevent the heat being applied in such a manner as to fractionally destructively distil the coal, so as to eliminate the volatile matters and crack up these volatile matters under appropriate temperature. In the case of horizontal and inclined retorts, the volatile products are necessarily subjected to the action of radiant heat of the same high temperature as that employed to eliminate the volatile matters from the coal, which experience with the Peebles process demonstrated was too high—more particularly during the latter stages of the carbonization, when the volatile matters evolved from the internal portion of the charge of coal have already had to pass through, and come into contact with, the outer coked portion. Over-carbonization is evidenced by the poor quality of the gas, and by the presence of cyanogen and free nitrogen resulting from the decomposition of a part of the ammonia; and in the case of vertical retorts there is either no free space, or no attempt made to regulate the size or temperature of such free space to that appropriate for the purpose of cracking-up and gasifying the volatile matters.

These facts warrant us in anticipating that, by the adoption of vertical retorts for the production of gas from coal upon the principles described, there will not only be a considerably increased yield of ammonia, as was the case in the shale-oil industry, arising from the fractional application of the steam and water gas to the nitrogenous constituents, but that there will also be a considerable gain from the volatile hydrocarbon constituents being fractionally cracked-up, as in the Peebles process, and by the water gas resulting from the ammonia producing process being thereby more effectively carburetted and enriched.

What will be the actual gain from these sources, will depend upon a number of factors—such as the character and constitution of the coal carbonized; the weight of coal carbonized per unit of time; the quantity of steam or water gas used per unit-weight of coal; and the percentage of water gas added to the gas produced from the coal. As a general rule, the larger the percentage of hydrocarbonaceous volatile matters and percentage of nitrogen present in a coal, and the larger the quantity of the steam that can be used, and (in proportion to the water gas) that can be added before the coal gas is reduced below the necessary standard illuminating power, the larger will be the gain in both respects.

With the ordinary run of bituminous coal, past experience in the working of the Peebles process would indicate a gain of at least 10 per cent. in the enrichment volume of the volatile products from the coal, with an increase in volume of from 20 to 30 per cent., due to the added water gas. And experience with the recovery of ammonia from the nitrogenous carbon in coals and shales in connection with the oil industry would lead me to expect that by the use of such a quantity of steam as would produce 3000 to 5000 cubic feet of water gas per ton of coal, the yield of ammonia would be increased from 30 to 50 per cent. With a larger use of steam and production of water gas, the ammonia would be proportionately increased till the yield might be practically doubled or more.

It has to be kept in mind, however, that, in order to obtain the nitrogen as ammonia, the steam must be used under such conditions as will produce a water gas containing at least 10 per cent. of carbonic acid, and provision must be made for dealing with this gas. Possibly its production might be somewhat reduced by substituting for the steam water gas produced in a separate water-gas plant, or saturating the water gas with water vapour by making it come into contact with hot water on its way to the retorts, in the manner described in using air in the carbonizing of shales. But my experience is that such a method would be less effective in the elimination of the nitrogen as ammonia than pure steam; the nascent hydrogen at the instant of its liberation from the steam appearing to be more active than free hydrogen gas. Another and very convenient way of meeting the difficulty, and probably in many circumstances an economical one, would be to carburet or enrich the gas with suitable oils to an extent sufficient to counteract the diluting effects of the presence of the carbonic acid in the water gas.

The method of continuously feeding the coal lends itself to such a mode of enrichment, as a stream of enriching oil could be very conveniently made to flow from an overhead tank into the feeding hopper over the surface of the coal. In this way it would be continuously introduced into the retorts, and cracked up in accordance with the Peebles process; and ordinary gas oil could be made to give an enriching value of from 1800 to 2000 candles per gallon.

Still another, and what I believe will ultimately prove to be the better, method of overcoming the difficulty—more particularly if considerable quantities of water gas are produced with the object of obtaining a largely increased yield of ammonia—will be to remove the carbonic acid from the gas by the use of the ammonia, by a modification of the process to which reference was made in the earlier of these communications.

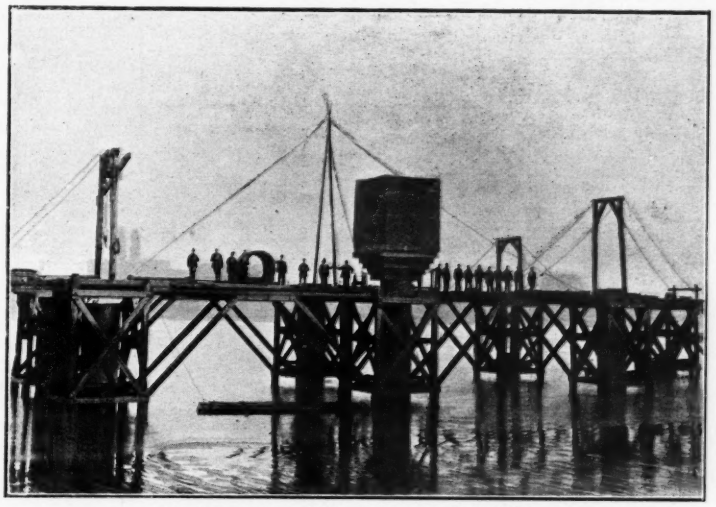
The trend of events indicates that, with modern appliances, a gas of lower grade will be equally suitable as, and in many cases even more suitable than, that at present supplied; and that a gas having a calorific value higher than water gas obtained by the use of coke, but lower than ordinary coal gas, if it could be manufactured and supplied at a lower price per thermal unit, and provided it was sufficiently free from carbonic oxide to be safely used for domestic purposes, would be the best gas to supply.

Along with others, I have been for some time (and am at present) considering a process for gasifying coal in an improved arrangement of producer for the manufacture of such a gas. By the process it is intended to remove the carbonic acid, or at least the major portion of it by the use of the ammonia produced from the coal by a modification of the ammonia purification process already mentioned. The combined process is not yet sufficiently developed for publication. I hope, however, to have the pleasure of making, at an early date, a further communication to the "JOURNAL" on the subject.

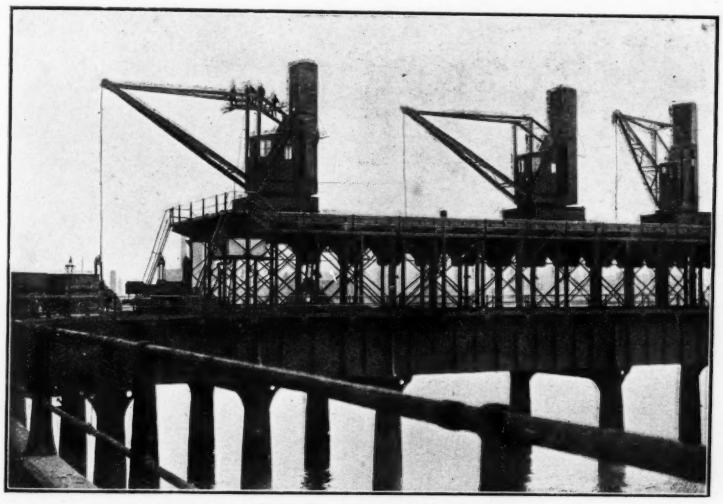
Presentation.—Mr. Matthew Mildred, of Bankside, S.E., lately celebrated his sixtieth birthday; and the event promoted a little festivity in which a goodly number of Mr. Mildred's workpeople and private friends had the pleasure of sharing. Congratulations and good wishes were showered upon the central figure of the occasion. As a mark of their regard and appreciation of kindly treatment, the workmen presented Mr. Mildred with a spirit and cigar cabinet; and some friends gave him three handsome vases.

NEW COAL-DISCHARGING PLANT AT EAST GREENWICH.

A few particulars by Mr. J. Tysoe (together with some photographs by Mr. R. M. Tysoe) of the new coal-discharging plant at the East Greenwich Station of the South Metropolitan Gas Company appear in the current number of the "Co-Partnership Journal." The two illustrations which we reproduce show the extension of the jetty—designed by the Chief Engineer, Mr. Charles Carpenter—and the new coaling-cranes at different periods of its construction. The top one indicates the method of weighting the cylinders in order to ensure their final stability under the greatest load that will be brought to bear upon them in actual work. The pile of iron there depicted weighs about 450 tons. The other shows the structure practically completed. There are four cranes; but the photographer omitted to show one of them. Unlike the work on the old portion of the jetty, in which the skips or buckets are filled by hand, these new cranes are provided with grabs, which are self-filling, and the saving



East Greenwich Jetty—Weighting the Cylinders.



East Greenwich Jetty—Coal-Discharging Plant.

which results from such a method is, of course, very considerable.

The grabs weigh 33 cwt. each, and hold 25 cwt. of coal. With ships of modern construction, built with a view of facilitating the working of grabs, the rate of discharge is about 1000 tons in seven hours. To perform this work, about 130,000 gallons of water are required; and this is supplied at a pressure of 750 lbs. per square inch. The grabs are discharged into hoppers—shown in the illustration of the completed work—which in turn are discharged into trucks (two of which appear at the extreme left of the photo), by means of hinged shoots at the bottom. This arrangement permits of continuous discharge from the ships. Without the storage hoppers, the cranes would have to cease working if the empty waggons were not in position. About half a million tons of coal are discharged yearly at East Greenwich; and the saving effected represents a big sum in the course of twelve months.

PERSONAL.

Mr. James Anderson has been appointed a Director of the Rosario Water-Works Company, Limited, in place of the late Mr. John Morris.

Mr. James Andrew, who has been appointed Engineer to the Perth (W. A.) Gas Company, is a nephew of Mr. Arthur Andrew, of Oldham. Entering the Gas and Water Office in that town as a boy, he filled successively the positions of clerk, assistant draughtsman, clerk of works, assistant outdoor foreman, chief draughtsman, and surveyor to the Gas and Water Departments. The latter position he held about ten years; and at present he is Works Manager of the Central Gas Station. He was trained under his father, the late Mr. Herbert Andrew, who was Chief Superintendent of the Oldham Gas and Water Works up to the time of his death in 1894, and under the late Mr. John Chadwick, the Gas Engineer and Manager. Mr. Andrews leaves England on the 18th prox. to take up his new position.

Mr. W. E. Dean, who has been appointed Assistant-Manager to the Torquay Gas Company, entered the service of the Tottenham and Edmonton Gas Company in 1893, and was under the late Mr. W. H. H. Broadberry, who was Engineer to the Company until his death in 1899. He then served the remainder of his time under the present Engineer, Mr. A. E. Broadberry. The great progress made by the Company has, of course, provided Mr. Dean with exceptional opportunities for gaining experience in the construction and operation of modern gas-works plant. During the last five years, the works have almost been entirely remodelled. Mr. Dean is the Junior Vice-President of the London and Southern District Junior Gas Association, which position he will reluctantly have to relinquish on taking up his duties at Torquay.

A pleasant ceremony recently took place at the works of the Mitcham and Wimbledon Gas Company, when the employees, to the number of 130, assembled outside the residence of Mr. Benjamin Green, the Secretary and Manager, to ask his acceptance of a memento of the completion of his fifty years' connection with the gas industry, forty of which have been spent with the Company. It took the form of a silver salver, bearing the following inscription: "Presented to Benjamin Green by the staff and employees of the Mitcham and Wimbledon Gaslight Company, to commemorate his completion of fifty years in the gas industry, and as a token of esteem and affectionate regard." The presentation was made on behalf of the donors by the Accountant of the Company (Mr. D. Forbes), who referred to the genial tact and courtesy which Mr. Green had always shown in his relations with them, and pointed to the growth in the Company's capital and business and to the present excellent condition of the works as evidence of his administrative ability. He expressed the sincere wish of all present that Mr. and Mrs. Green and their family might long be spared to be among them. Mr. Green, in acknowledging the gift, said he was unable adequately to give utterance to the gratitude he felt for the beautiful gift he had received. He should always prize it, and it would be handed down as a family heirloom; for it conveyed to his mind the fact that he had the full confidence and support of the staff and employees of the Company, which he very greatly appreciated. They had always been faithful and true to him; and he had done the best he could to make them happy and comfortable.

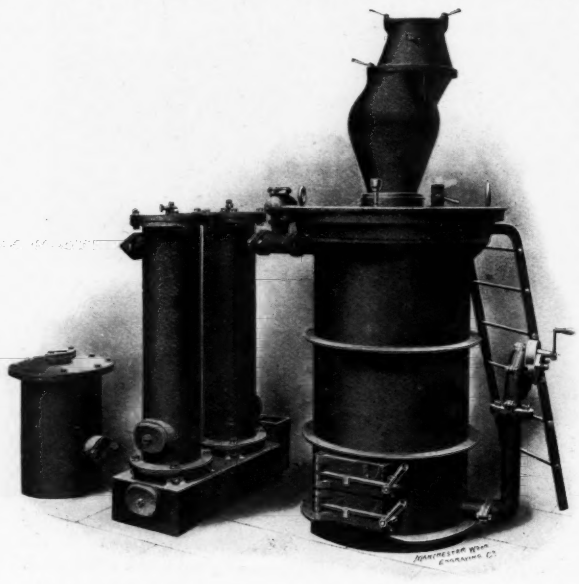
At the meeting of the Institution of Civil Engineers last Tuesday, it was announced that Mr. J. M. Price-Williams, of the Tees Valley Water Board, had been transferred from the class of associate members to that of members.

THE PRESENT AND FUTURE OF POWER-GAS PLANTS.

The Utilization of Peat.

At a recent Meeting of the Engineering and Scientific Association of Ireland, a paper on "Power-Gas Plants: Their Present Applications and Future Possibilities, with Special Reference to Ireland," was read by Mr. T. Rigby, A.M.I.Mech.E., F.C.S. The subject was made specially interesting to the audience by means of a number of lantern slides.

The author began by explaining that his paper was intended to show on what lines the use of gas power is likely to be employed in Ireland, and his own views on the matter. The main question



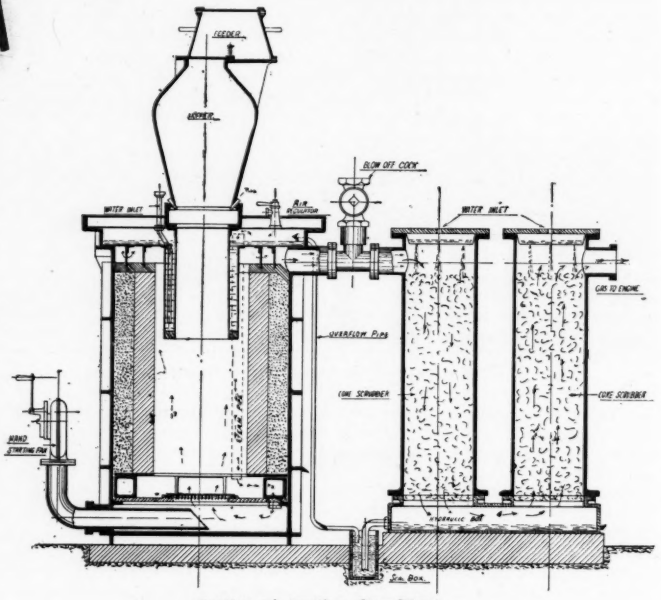
View of Typical Crossley Suction Gas Plant.

was, of course, the kind of fuel that should be used; and this depended, in great measure, on the price at which it could be purchased. Unfortunately, the supply of fuel from the Irish coalfields was very limited—the greater bulk of the coal burnt in the country being imported. As a consequence, the price of most kinds of fuels obtainable was rather high as compared with that in use in Great Britain; and it might be advisable to say, in the first place, that all carbonaceous fuels could be used for the production of power gas, and that the deciding factor as to the type of plant to be employed should be the price of fuel in relation to its heat value. The difference in price between the two main fuels used in Ireland—viz., anthracite and Welsh or Scotch semi-bituminous fuel—was very small; and for this reason, under present conditions, in the majority of cases, the best fuel to use was anthracite, not only for its greater heat value, but also because the plant required for converting it into gas was very simple.

Mr. Rigby then traced the progress of power-gas production from the pioneer work of Mr. J. Emerson Dowson in 1878, and that of Bénier, who, about ten years ago, conceived the idea of making the piston of the gas-engine aspirate the gas direct from the producer, without any intermediate storage or gasholder, down to 1901, when several firms on the Continent and his own firm (Messrs. Crossley Bros., Limited) in England were simultaneously experimenting with the suction plant evolved by the French investigator. At the Royal Agricultural Society's show at Cardiff in the last-named year, Messrs. Crossley showed and worked a gas-producer which dispensed with the use of a steam-boiler and gasholder; and at the Society's show at Park Royal in 1903, Mr. Dowson showed his first suction plant. Since that date numerous other firms have entered the field with various types of plant using anthracite fuel; but all of them possess the main principle originated by Bénier, whereby the gas is drawn into the cylinder during the suction stroke of a gas-engine. Since the Cardiff show, Messrs. Crossley have made something like 30,000-horse power of gas plants working on the suction principle, and have now equipped special works for the purpose of building them.

The author threw on to the screen two slides showing an elevation and a section of a typical suction plant as made by his firm, and explained its construction. He pointed out that the fuel is contained in a cylindrical fire-brick chamber. The vaporizer is in the upper portion of the producer, and is constructed entirely of welded steel plates. In the centre of the boiler is arranged fuel storage capacity in such a manner that the fuel in the producer is kept at a constant working depth. The lower portion of the boiler defines the working fuel depth. An air-locking device is arranged in the upper portion, so that fuel can be charged while the plant is at work without any risk of drawing in air from the atmosphere. A storage capacity of four hours' supply at full load is provided. At the lower portion of the producer the fire-brick lining is kept a few inches from the grate; and all the air and steam going into the producer enters through the fire-grate proper. The consequence is that, the highest temperature being found at the grate level, any clinker formed in the producer collects on the fire-grate, whence it can easily be detached in a flat cake, without interfering with good working. It is necessary for efficient gas production that a solid depth of fire be maintained constantly.

One of the difficulties experienced by makers of suction gas plant has been the regulation of the steam produced, so as to keep something like a proportionate quantity of air to steam passing through the fire constantly. The way in which this difficulty has been overcome by Messrs. Crossley is to arrange two separate air-inlets—one, the primary air supply, leading direct to the under-side of the fire-grate; and the other, the secondary air supply, being arranged above the steam boiler or vaporizer. The path of least resistance for the air entering the fire will be by way of the primary inlet; and if the area of the orifices of both primary and secondary inlets are adjusted, it is possible to ensure that the quantity of air entering the primary inlet is nearly constant, by constricting it somewhat. If then the quantity of air that can pass through such a constricted orifice is so limited that it is not sufficient to produce gas enough to drive the engine on a light load, it is evident that when any working load at all is on the engine, the remainder of the air must necessarily pass through the secondary cock above the vaporizer. This is so arranged that air entering must pass over the surface of the hot water in the vaporizer, with the consequence that it is saturated

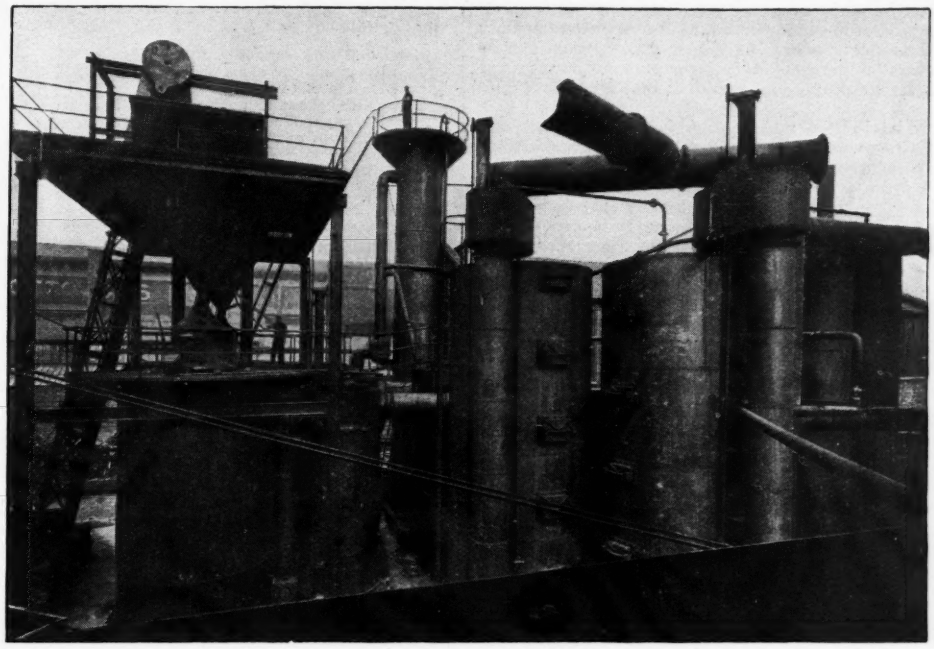


Section of Suction Gas Plant.

with water vapour, and so the quantity of steam admitted to the fire is limited to exactly what is required.

Mr. Rigby went on to point out that though all suction gas-producers work on Bénier's principle, it is with modifications of design such as those he had described that successful working is ensured, and all improvements in plants using anthracite fuel are now in such details of design. He laid stress upon the fact that there is no limit within reason to the number of engines which can be worked from a suction plant, and he said that a considerable number had been put to work, having several engines working from one plant. At the works of Messrs. G. & J. Weir, Engineers, of Glasgow, there is a plant of 200 brake-horse-power capacity which is supplying seven engines. There is a great demand at the present time for such combinations for use for various electrical purposes; and the author gave particulars of several installations fitted up by his firm, and showed them by means of slides. For further information, he referred his audience to the paper he read before the Manchester Association of Engineers about twelve months ago, a full abstract of which was given in the "Journal" for the 2nd of May (p. 308).

Passing on to the subject of the fuel to be employed, Mr. Rigby explained that when using English bituminous coal it is not possible to work on the suction principle, mainly on account of the condensable hydrocarbons or the tarry vapours given off,

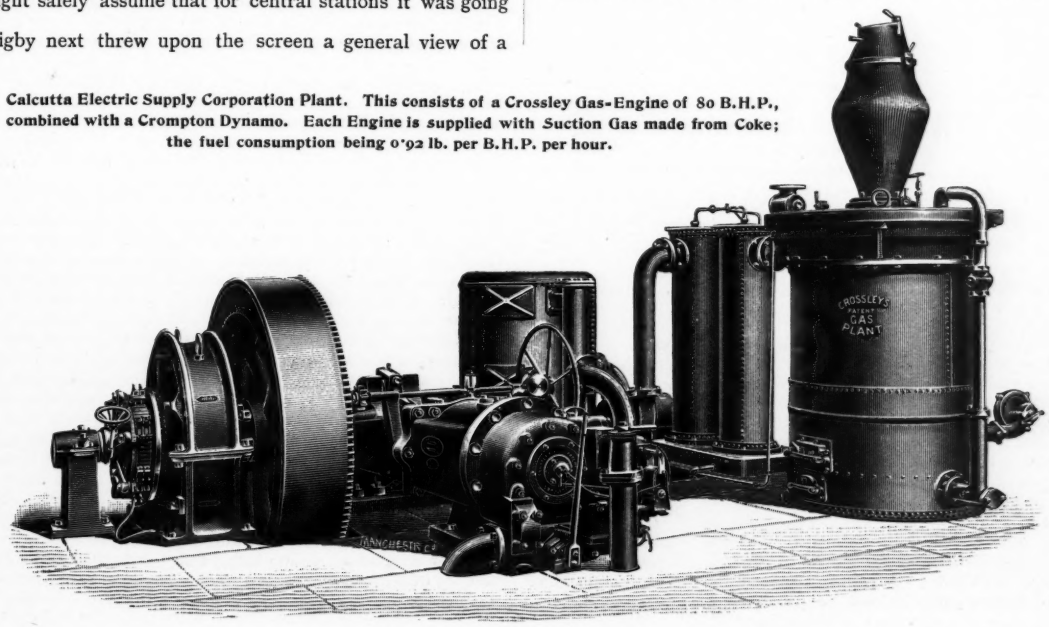


General View of the Mond Gas Plant.

from which the gas has to be thoroughly purified before being fit for use in a gas-engine. Moreover, most of the fuels in England cake very hard when heated, with the result that the solid bed of fuel necessary for good gas production is not easily obtainable, and a special design of producer is required. As the result of much experimental work by Mr. Rigby, this difficulty has been overcome; and he showed on the screen a general view and a section of plant which Messrs. Crossley are constructing for the utilization of bituminous coal. It consists mainly of: (1) The gas-producer, (2) the air saturator and hydraulic box, (3) the gas coolers and washers, (4) the centrifugal tar-extractor, (5) the gas-purifier, (6) auxiliary machinery, consisting of an air-blower and a circulating water-pump, and the arrangement for driving these and the centrifugal tar-extractor. It is different from that used for suction forms of plant. In the first place, it is much greater in depth and diameter; and, secondly, ample facilities are given to ensure that the fire is always solid. Mr. Rigby stated that such a producer can be worked for months in succession without stopping; the lower portion being sealed in water so that the ashes may be taken out at any time without interfering with the production of gas. He added that plants of his firm's design had been constructed from 100 to 3000 horse power; and that about forty were working in this country at the present time. During the last twenty years, they had fitted up with gas power something like fifty central electric light stations, mostly on the Continent. For various reasons, this kind of power had not, he said, been much encouraged in England; but he thought that, after the progress made during the past five years, electrical engineers might safely assume that for central stations it was going to stay.

Mr. Rigby next threw upon the screen a general view of a Mond gas plant, and in the course of his description of it alluded to the recovery of sulphate of ammonia. His remarks, of course, referred to experience in England; but he proceeded to deal with the question as to applying to Ireland, the coal used in which country is mostly imported, owing to the fact that the fuel supplies have not so far been worked to any great extent. In 1895, the total quantity of coal raised was approximately 125,000 tons; whereas in 1904 it was not more than about 105,000 tons. Ireland, however, possessed a valuable national asset, though it had not been tapped to any extent, in her extensive deposits of peat. It would seem that there are in Ireland something like 2,830,000 English acres of bog land of an average depth of about 20 feet. It contains a great deal of moisture, which is generally about 90 per cent. by weight; but it is possible to dry this commercially, and reduce it to something less than 30 per cent. by weight. The author stated that peat is really an ideal fuel for gas-producers, but when used for steam-boilers and the like it does not do so well. The conditions of working for the former are entirely different from that of an ordinary fire; and from experiments he has made, he has formed the opinion that it could be used very satisfactorily for the production of gas for power purposes. According to Dr. Dvorkovitz, the President of the Petroleum Institute, there are in Ireland 7440 million tons of dry peat, having a calorific value of 12,000 B.T.U. per pound when perfectly dry. As it is difficult to get it dry, it may be assumed that the calorific value obtainable in actual work would not be more than 6000 B.T.U. per pound weight; so that 2 lbs. of peat may be taken as being equal in value to about 1 lb. of bituminous coal. If peat could be

Calcutta Electric Supply Corporation Plant. This consists of a Crossley Gas-Engine of 80 B.H.P., combined with a Crompton Dynamo. Each Engine is supplied with Suction Gas made from Coke; the fuel consumption being 0·92 lb. per B.H.P. per hour.



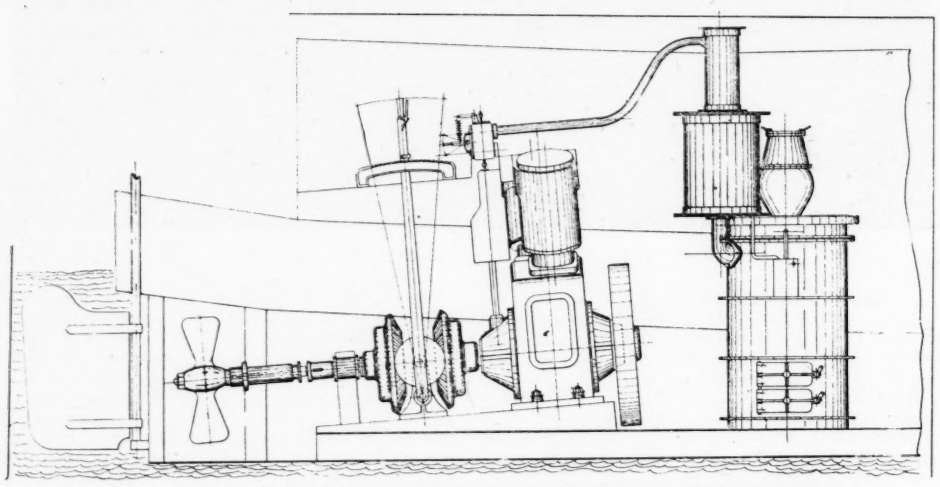
obtained close to the place of power production, the author said it would pay to gasify it in plants of from 100-horse power capacity upwards. Unfortunately, where the majority of the peat can be obtained, there are at present no requirements for power; and how to take advantage of this vast wealth of fuel is rather a difficult problem.

Mr. Rigby has lately been making experiments with peat, and these, together with evidence that he has collected from various sources, prove conclusively that the majority of the peat in Ireland contains a large proportion of nitrogen in its composition. In the dry fuel it varies from about 1 up to 2 per cent. by weight; the average being about 1½ per cent. It has been proved that this peat can be successfully treated for the recovery of the original nitrogen in the fuel in the form of sulphate of ammonia; and this being the case, the outlook is altered considerably in his opinion, as, if treated on a large scale, the bye-products obtained from it are very valuable. From published figures, it seems to him that it would pay to treat the peat for the recovery of ammonia and other products alone. There is already a process at work at Kilberry, in the North of Ireland; and it appears that the process employed at the Irish Peat Company works out somewhat as follows:—

Distillation of 100 tons of peat yielded—			
1 ton of sulphate of ammonia	£12	0	0
¾ ton of acetate of lime	9	10	0
50 gallons of naphtha	12	10	0
300 lbs. of paraffin	15	0	0
300 gallons of volatile oils	15	0	0
	£64	0	0

Cost of production—peat, acids, labour, &c., £32.

The author said it was evident that those who are working this process are treating the wet fuel. But he was of opinion that it could be subjected to a simple process of air-drying by fan blast as collected, before being used for gas-producer work; and as in practice it is possible to obtain 75 per cent. of the original nitrogen in the fuel in the sulphate of ammonia, a large plant making producer gas with sulphate recovery would, he considered, be a very remunerative investment. Peat containing about 30 per cent. of moisture was very easy to obtain if subjected to the air-drying process; and the weight of sulphate of ammonia derived from a ton of such fuel would be approximately 1 cwt. In addition to this, there would be produced gas of the equivalent of about 1000 horse-power-hours from the same weight of fuel. It would therefore be seen that vast possibilities are opened out from the fact that power could be obtained from this peat for nothing—that is to say, plant put down on such lines would pay as an investment for the recovery of the bye-products, without taking into consideration any power gas at all. The following is the estimated cost of working an ammonia-recovery plant gasifying 10 tons of peat per hour for one year of 8500 hours:—



Arrangement of Vertical Gas-Engine with Suction Gas Plant for Canal-Barge Propulsion.

Capital Charges.

Cost of ammonia-recovery plant, including boilers	£35,000
Air-drying plant	2,000
Trolleys and rails for collecting peat	5,000
Total capital cost	£42,000

Expenditure.

Interest and depreciation at 10 per cent.	£4,200
Repairs and maintenance at 2 per cent.	840
Labour on plant	2,000
Lighting, lubricants, and stores	1,000
Labour collecting peat, and drainage	4,000
Management and office expenses	1,500
Cost of acid	6,000
Royalty on peat, at 1s. per ton	4,250
Total	£23,790

Receipts.

4250 tons of sulphate of ammonia, at £12 per ton	£51,000

Showing a balance of £27,210.

Mr. Rigby then went on to refer to other purposes for which cheap power would be suitable, among them being haulage on canals, to which, as our readers are aware, some attention has lately been given. Another direction in which developments are now proceeding is in the application of the internal-combustion engine and power-gas plant for marine purposes. The author's firm have investigated this question quite recently, and at the present time they are designing a gas-engine of about 600-horse power, together with a producer plant, to use either bituminous or anthracite coals. This combination will be fitted in a steamer of 2000 tons capacity intended for general trading purposes. A great many problems require to be solved in such an application; but the firm are confident that it will be successful, and that the fuel consumption should be not more than one-half that of the best steam practice at present in use. Mr. Rigby concluded by pointing out that obstacles which have previously stood in the way of the advance of internal-combustion engines are from time to time being removed; and he is confident that these engines will in the near future replace all other prime movers, whether on land or on sea.

New Business Methods.

The well-printed and instructive volume now before us calls to mind the short series of articles contributed to the columns of the "JOURNAL" by the late Mr. E. W. T. Richmond some few years ago, under the title of "Business Methods in America." Mr. Richmond, as a result of a journey through the United States and Canada, was much struck by the activity in effort and staff-specializing that he found pervaded the gas undertakings in connection with their dealings with the public, in order to promote the consumption of gas. The volume now under notice is entitled "New Business Methods;" and it emanates from the Ohio Gaslight Association—Mr. George Williams, of Madison, Wis., being the Editor. He has done his work well. The large collection of resulting methods and experiences that he has made, in the name of the Association, will serve the good purpose of enabling gas administrators on the other side to construct an eclectic system for business propagation which will prove valuable. Of course, it is found that methods that are suitable in one place will not all be so in another place; and therefore it is necessary to make a wise discrimination. The volume enables this to be done, for the range of methods offered is wide, coming from such a great number of sources, whose characteristics are varied. Illustrated advertisement, circulars, cards, and attractive leaflets sent by post, show-rooms with model kitchens, canvassers, the division of a town or city into districts, and each district confided to a responsible man paid by salary and a commission for new business, displayed advertisements at places of public resort, and special invitations to ladies to inspect the show-rooms without soliciting orders, are a few samples of the methods adopted. We have been much interested in reading through considerable parts of the volume, and are confident of its suggestive utility.

The late Mr. Joseph Aird, of the Wellington Tube-Works, Great Bridge, Staffs, and Whitehall Court, left estate valued at £11,310 gross and £5299 net. Subject to certain legacies, the residue of the property goes to his nephew, Mr. John Aird, jun., upon trust.

PLAISSETTY SOFT MANTLES.

SEVERAL ideas have been made public through the Patent Office for supplanting the ordinary form of finished mantles. The objects in view have been to obtain mantles or incandescing material which will not be subject to damage in transit, and to avoid the depreciating effects that investigators (more particularly Continental ones) have stated results from the subjecting of the mantles to the amount of collodionizing, after burning out the base fabric and hardening, necessary to admit of their safe transport. But after publication by the Patent Office, nothing more has been heard of these ideas. But that there is something in the incentives to these inventions is shown by the fact that Continental and London gas undertakings are doing their own burning-off for certain purposes.

In the "JOURNAL" for March 6, we referred to the new flexible mantles which the Plaissetty Manufacturing Company have just brought out for inverted burners, with which mantles until they are placed on the burners the liberty may be taken of crushing with impunity. When, however, they are placed in position on the burner, and then for the first time burnt off, the mantles adjust themselves in shape to the formation of the flame. The Company have now succeeded in achieving similar results to those then described with mantles for use on the ordinary vertical form of burner. By the new process (for which, we are informed, protection has been secured), mantles intended for use on upright burners of any size and make can now be prepared and placed on the market in stocking form, in such a way that they may be burnt off on their particular burner by the consumer. The mantles will be cut to the proper length for the burner for which they are intended before leaving the hands of the Plaissetty Company; but, from the trials that we have made with these pliant mantles, it would be necessary in the first place to give the ordinary gas consumer a little instruction in their use. In burning-off, there is a considerable shrinkage of the mantle; and therefore the mantle must be, when in its unburnt state, longer than its ultimate length. It is at first a little awkward to deal with them. The heads of the mantle have to be tucked in, and the skirt has a tendency to come in contact with the gallery of the ordinary form of burner. But once the mantle is placed in position, and a flame applied, it is soon reduced to its ordinary size. On a Welsbach-Kern burner, there is no difficulty in this respect, as there is no gallery to negotiate. A little practice, however, goes a long way. The fabric, it should be mentioned, is slightly collodionized to accelerate the burning off. There is one thing about which warning should be made; and it is that the full illuminating power of the mantle is not so rapidly developed as in the case of the ordinary mantle. Unless this is fully understood, it may be detrimental to the proper trial and use of these soft mantles. It is remarkable what an amount of violent vibration these mantles will stand after their burning off.

These are some of the advantages that the Company claim for the mantles: "(1) The ash fabric of the mantle has not to be subjected to the same amount of treatment as previously by collodion; and the consequent weakening of the fabric is avoided. A mantle of three or four times the strength of the old mantle is obtained. The resistance to vibration is remarkable, and makes the mantle peculiarly suitable for the lighting of streets, railways, and factories. The householder will also get a mantle which will outlast three or four of the old mantles. (2) There is no risk of damage in packing or transit. The user can rely upon every mantle as it reaches him being sound. (3) In the case of export, the mantles cannot be damaged; every one will arrive in perfect condition. The bulk and weight of the packages will also be reduced to one-fifth of the old packages." The great thing is that nothing can happen to the mantles, between their manufacturing stage and the consumers' burner, to contribute to their wrecking. The sample mantles that we have received were purposely delivered in a crumpled and disordered state to prove this point. There may be some difficulty in getting private consumers to adopt mantles in this form, owing to the little additional trouble involved; but gas undertakings whose business includes the maintenance of street-lamps and private burners may find it to their advantage to test them.

MOND GAS AND POWER TRANSMISSION.

Mr. Emile S. Mond, the Managing-Director of the Power Gas Corporation, Limited, has written to the "Journal of the Society of Arts" on the subject of the paper read before the Society by Mr. A. J. Martin on the 28th ult., and given in the "JOURNAL" a fortnight ago (p. 26), in the course of which reference was made to the cost of Mond gas. The writer expresses regret that Mr. Martin did not ask the Power Gas Corporation, as owners of the Mond patents, for particulars as to the cost of manufacturing the gas, as they would have been only too glad to give him information on this subject, and also on the question of the transmission of gas, in which they have had considerable experience. They were able to place in Mr. Martin's hands statements of the cost of producing Mond gas which have now been published for some years; and under favourable circumstances, even better results have been obtained in practice. These statements are shown in the accompanying tables.

Statement of Annual Working Cost of 20,000-Horse Power Plant with Ammonia Recovery, Working Continuously at Full Load, for 365 Days of 24 Hours.

Total fuel (91,250 tons), including that required to raise all necessary steam, at 6s. per ton . . .	£27,375	0	0
Wages at producers, boilers, sulphate recovery, and evaporating plants (including handling of coal and ashes, also shipping of sulphate).	4,859	0	0
Sulphuric acid, at 30s. per ton, also lubricants, lighting, stores, repairs (including wages and materials for same).	6,456	0	0
	£38,690	0	0
Less 2920 tons of sulphate, at £10 per ton. . .	29,200	0	0
Net cost per annum	£9,490	0	0

Cost of available gas per 1000 cubic feet, 0·2213d.

Statement of Annual Working Cost of a 20,000-Horse Power Plant with Ammonia Recovery, Working under a Variable Load which is Equal to Half Load Throughout.

Total fuel (46,125 tons), including that required to raise all necessary steam and (also stand-by losses of half plant when standing for 12 hours every day), at 6s. per ton.	£13,837	10	0
Wages at producers, boilers, sulphate recovery, and evaporation plant (including handling of coals and ashes, also shipping of sulphate)	4,133	15	0
Sulphuric acid, at 30s. per ton, also lubricants, lighting, stores, repairs (including wages and materials for same)	4,010	10	0
	£21,981	15	0
Less 1460 tons of sulphate, at £10 per ton . .	14,600	0	0
Net cost per annum	£7,381	15	0

Cost of available gas per 1000 cubic feet, 0·3467d.

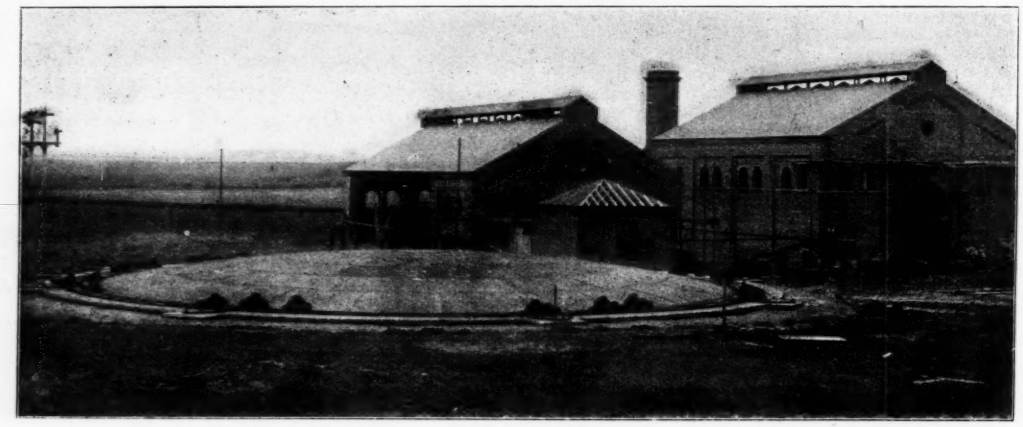
Mr. Mond points out that, taking coal at the price mentioned in Mr. Martin's paper—6s. per ton—the cost of manufacturing Mond gas would have been about one-third of that stated by him. He says that there is no doubt that at the pit's mouth bituminous slack, suitable for use in Mond producers, can be obtained at 3s. 6d. per ton; and if an allowance for this is made in the tables, and at the same time sulphate of ammonia is taken at the present market price of £12 10s. instead of £10 per ton, it will be seen that the bye-products more than pay for the actual cost of the gas, and leave a considerable sum over towards the cost of compression and transmission. This would alter Mr. Martin's diagram [in which he showed the volume and cost of Mond gas as compared with coal and water gas] to such an extent that Mond gas would prove to be much cheaper to manufacture, compress, and transmit than either coal gas or water gas, without making any changes in the cost of compression and transmission from the figures assumed by the author.

Referring to Mr. Martin's remarks as to the necessity of providing chemical fertilizers for the growth of our future wheat crops, in order to keep pace with the demands for wheat of a growing population, Mr. Mond points out that by the Mond process four times as much sulphate of ammonia is produced per ton of coal as can be obtained by the process of converting coal into ordinary illuminating gas. He adds that the Corporation he represents fully agree with the author of the paper that the supply of a cheap gaseous fuel, which, while entirely overcoming the smoke nuisance, would lead to enormous economies in the use of coal, is one of national importance, and that the subject will continue to force itself upon the attention of local authorities, especially those who have charge of public matters in large cities where smoke and fog are so troublesome, until schemes perhaps more modest than that proposed by the author, but still somewhat on the same lines, become accomplished facts.

Amalgamation of German Incandescent Gas Companies.—The Actien Gesellschaft für Gasglühlicht (the Incandescent Gaslight Company) is the title of a new concern which has been formed in Berlin by the Allgemeine Glühlichtwerke, Dr. Alfred Oppenheim and Co., Julius Norden and Co., and the Chemische Fabrik of Dr. Willy Saulmann Company. Of the total capital of £55,000, the Allgemeinewerke take over £11,000, Julius Norden and Co. £13,500, the Saulmann Company £12,250, Julius Janz £11,000, Gustave Janz £3750, and A. Salomon £3500. The object of the Company, which represents an amalgamation of five works for the purpose of excluding competition among themselves, is to manufacture and deal in chemical products of all kinds, and particularly in regard to those relating to incandescent gas lighting. The firm of Julius Norden and Co. will have a special share in the profits realized by the new Company, by way of compensation for the bringing in of the customers of the former and the organization of the English business. The Board comprises Herr J. Rosenfeld, Dr. W. Saulmann, Dr. N. Caro, and Herr M. Salomon, all of Charlottenburg. These gentlemen have undertaken not to participate during their term of office in any enterprise of a similar or accessory kind of business, the penalty for contravention being fixed at £2500 each.

THE WITHERNSEA NEW GAS-WORKS.

In last week's "Journal" there appeared a brief reference to the starting of the new gas-works at Withernsea, which have been constructed for the Holderness Gas Company, Limited; and we are to-day in a position to give the particulars (with some interesting illustrations) which it was then hinted might soon be forthcoming. By way of preface, it may be remarked that Withernsea, which lies about 20 miles east of Hull, is one of the rapidly developing summer resorts on the Yorkshire coast. At present it is partially lighted with gas by the North-Eastern Railway Company; this supply being supplemented by an acetylene gas-plant installed by the Urban District Council, which lights the promenade, band-stand, and some of the larger street-lamps. The large Convalescent Institution for the special treatment of pulmonary disease is also at present lighted by acetylene.

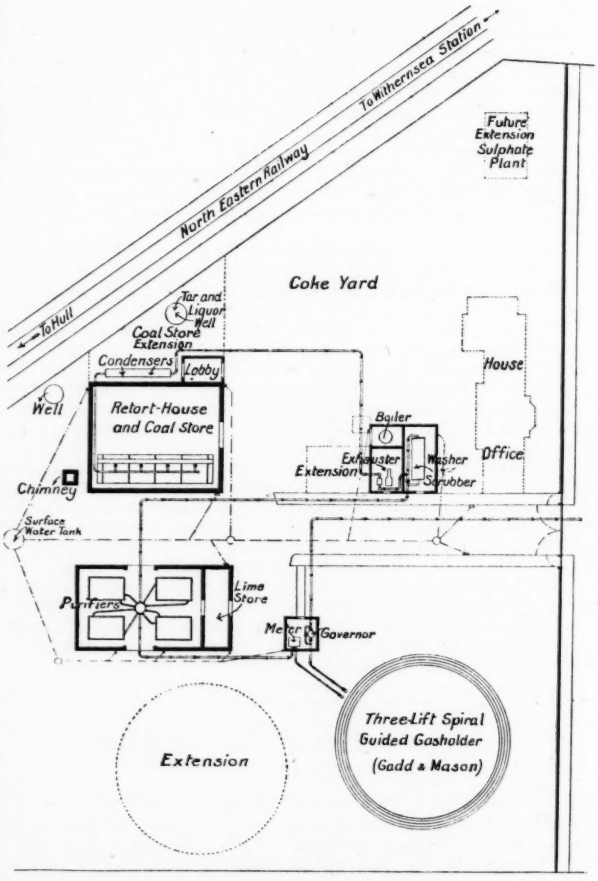


View of the Works (as nearing Completion) with the Gadd and Mason Holder in the Foreground.

The new gas-works have been laid out to meet an ultimate demand of 30 million cubic feet of gas per annum. The site, as will be seen from the complete works plan, adjoins the railway; and it is the intention of the Directors to apply for direct siding accommodation into the works, as soon as the development of the undertaking justifies the requisite capital expenditure. The necessary provision in the laying out of the retort-house and coal-store has been made to enable the extensions to be carried out in an economical manner. The works, when the whole of the sections are completed, will be as shown on the site plan. The elevations of office, manager's house, retort-house and coal-store, purifying-house, and meter-house are shown on the opposite page. The ironwork of the roof was supplied by Messrs. R. & J. Dempster, of Manchester.

The retort-house, coal-store, and men's messroom, with overhead water supply tank (from a private well), and condenser (see plan), form section No. 1 of the works as at present erected. The carbonizing plant consists of one bench of four arches. Of these four arches, two have been filled in (by Messrs. Gibbons) with six retorts each, 22 in. by 16 in. by 10 ft. long, on the generator system of firing. The condensers are of the tube type; and they have been placed temporarily in a sheltered recess against the coal-store. Section No. 2 comprises the exhauster and engine house, with a steam-boiler installation adjoining on the west side, and the scrubber-washer house on the east side. The engine and exhauster are of the Beale type, coupled direct; and the washer-scrubbers are of Messrs. Clapham Bros.' latest pattern. Section No. 3 consists of the purifier-house (with four 16 feet square boxes) and lime or oxide store; while section No. 4 is the house for the station meter and governor (supplied by Messrs. D. Bruce Peebles and Co.). The gasholder is a columnless one of three lifts, on the Gadd and Mason system, and erected by Messrs. R. & J. Dempster. The tank (which is of brick and cement, with puddle backing and cement and puddle cone) is 62 feet in diameter and 18 feet deep, and was constructed by Messrs. Pickering and Sons, a local firm.

The whole of the work was supervised and carried out on the ground by Mr. J. H. Downs as Clerk of Works, under the direction of the Company's Consulting Engineer, Mr. John Holliday, of Hull.

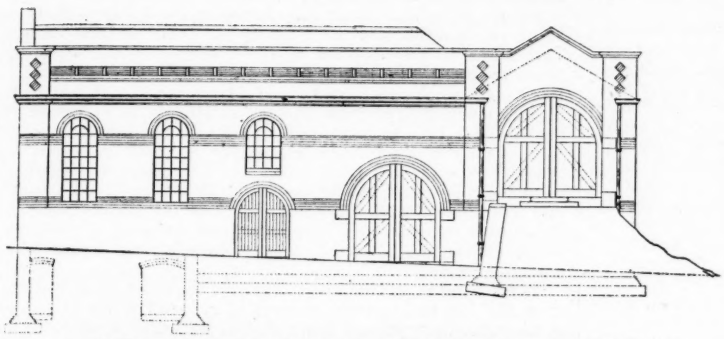


Ground Plan of the Works as at Present Erected.

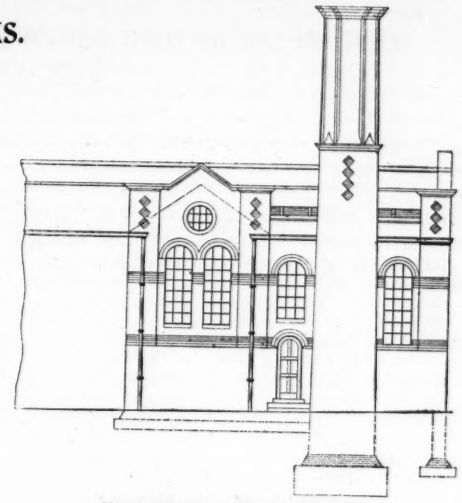
The Sixth International Congress of Applied Chemistry, which is to be held in Rome on the 26th inst., will be opened by His Majesty the King of Italy. The work of the congress is divided into eleven sections, in each of which an extensive programme has already been organized. Sir William Ramsay will give an address on the purification of sewage; Professor Moissan will lecture on the distillation of metals; and Dr. A. Frank, of Berlin, will deal with the direct utilization of atmospheric nitrogen in the manufacture of manures and chemical products. Among the numerous papers which have been received by the Committee is one on "The Extraction of Thorium and Cerium from Monazite Sand, and their Utilization in Welsbach Mantles."

THE WITHERNSEA NEW GAS-WORKS.

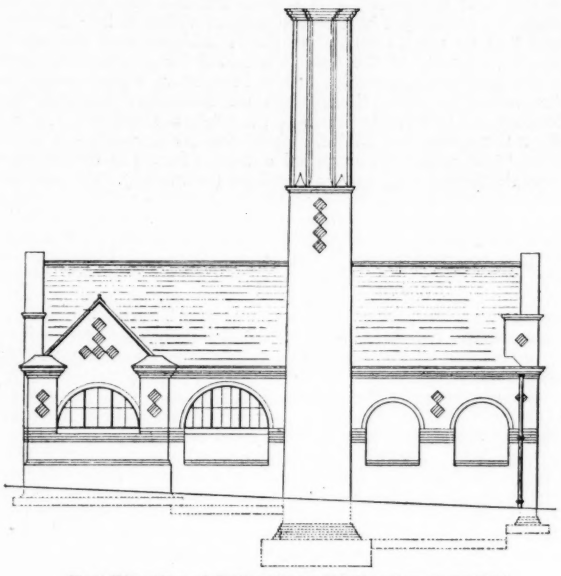
[See Opposite Page.]



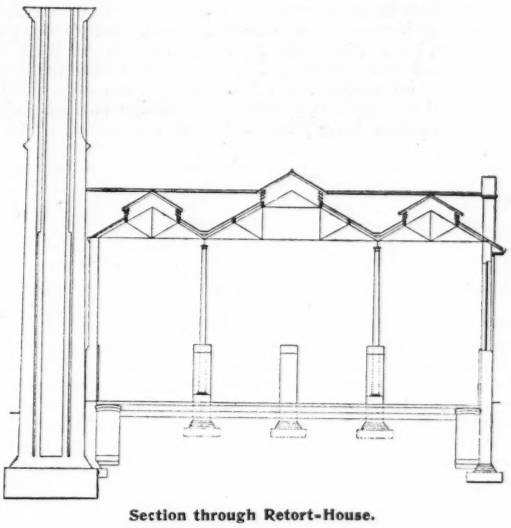
South Elevation of Retort-House, when Completed, with Overhead Siding and Entrance to Coal Store.



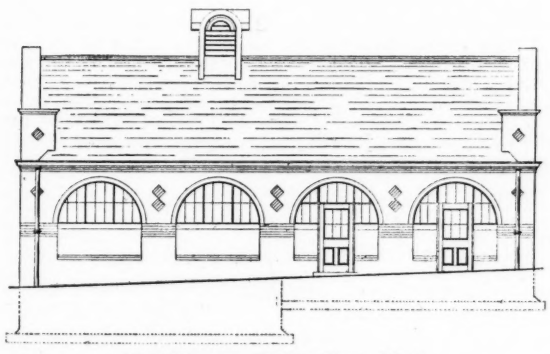
North Elevation of Retort-House.



East Elevation of Boiler-House Block, when Completed.



Section through Retort-House.



West Elevation of Boiler-House Block.

East Elevation of Purifier-House.

Production of Ethylene.—Referring to the well-known property of the carbides of different metals to yield hydrocarbons when acted upon by water (calcium carbide giving acetylene and aluminium carbide producing methane), "Nature" learns from the "Zeitschrift für Elektrochemie" that at St. Alban (France) a carbide is now being manufactured from which ethylene is evolved when it is acted upon by water. The ethylene so obtained is pumped into sulphuric acid, by which it is absorbed with production of ethyl hydrogen sulphate. When this is acted upon by water, alcohol and sulphuric acid are produced. By distillation, the alcohol can be obtained free from the sulphuric acid, and the latter can again be obtained in the concentrated condition by evaporation. Furthermore, the metallic oxide which is used in the production of the carbide is again obtained when the carbide is acted upon by water. Up to the present, it has been found necessary to use four times the quantity of carbon which should theoretically be required. How much more energy has to be employed than is necessary by the theory, is not stated. Our contemporary recalls the fact that so far back as 1893, when the calcium carbide industry was in its infancy, it was suggested that the acetylene might, by reduction with hydrogen, be converted into ethylene, and the latter be employed for the manufacture of alcohol. Owing to the difficulty of reducing acetylene, the process could hardly be expected to be a success. In the present case, however, provided the formation of the carbide is not too costly, and the recovery of the sulphuric acid and metallic oxide not too expensive, the process seems to possess the elements of success.

PHOTOMETRY OF HIGH-POWER LIGHTS.

A lengthy article upon the above subject, by Dr. Hugo Krüss, appeared in recent issues of the "Journal für Gasbeleuchtung," from which we have prepared the following abstract.

The author begins by pointing out that difficulties arise in ordinary photometry whenever the illuminating power of the light under test greatly exceeds that of the standard, more particularly when such burners have to be examined as the Millennium or the Selas, which develop up to 1500 or 2000 candle power. A comparison of the two lights thrown upon the photometer-disc is easiest and most trustworthy when that light does not exceed a certain figure; the most favourable intensity being from 0·8 to 1·6, or at the utmost 2·5 candle-feet. This cannot be arranged for with bar photometers of the usual dimensions, for the bar is seldom longer than 8 or 10 feet. The difficulties can be overcome when it is possible to erect the high-power light at a much greater distance from the photometer-disc—placing it, for instance, in an apartment adjoining the photometer-room, and allowing the direct rays to enter the latter only through an aperture of appropriate size and shape. Such an arrangement, however, is not always feasible; and therefore several methods have been elaborated by different photometrists for diminishing the intensity of the high-power light to a known degree, in order that the diminished light so obtained may be compared directly with the standard on a photometer of ordinary dimensions—a correction or factor being finally employed to eliminate the influence of the reduction that has been caused to take place.

Dr. Krüss in the first portion of his article reviews the different devices, drawing attention to the fact that he has no new process to describe, but that his object is rather to compare the different methods, and to so elaborate them when necessary that complications may be avoided, and that the operations involved may be rendered as simple as possible. The major part of his article is taken up with a description of the effect produced upon a beam of light coming from a source which seriously exceeds the dimensions of a mathematical point, by causing it to pass through concave or dispersing lenses; and there is an account of the plan whereby he has successfully used such dispersing lenses in the practical photometry of powerful units.

The Smoked-Glass Photometer.

The method of placing a piece of smoked glass in the path of the high-power rays, is the simplest of all; but it is by no means new. Most samples of obscured glass absorb to a different extent rays emanating from different parts of the spectrum, so that errors are liable to be introduced by their employment. It is possible, however, as the author has shown already, to procure a variety of smoked glass which has sensibly the same degrading effect on all light between the wave-lengths 656 and 486 $\mu\mu$—*i.e.*, between the Fraunhofer Lines C and F—its coefficient of translucency only ranging between 0·657 and 0·680, which is sufficiently uniform for technical purposes. When employed in a Lummer-Brodhun photometer, the smoked glass should be placed immediately in front of that face of the double prism through which the high-power rays enter it; and it is convenient to have three of such glasses, each of which transmits exactly one-fifth of the incident light. One, two, or all three of the glasses can be inserted in the photometer simultaneously, according to the intensity of the original light; the readings obtained being finally multiplied by 5, 25, or 125, as the case may be.

The Rotating-Disc Photometer.

The photometer in which the light from the high-power unit is periodically interrupted by the opaque portion of a revolving disc, is equally convenient to use, and only involves the additional operation of winding up a driving spring at intervals. The system, however, is not available in the photometry of alternating electric arcs. The author employs a pair of discs moveable one over the other, and each having an aperture of 180°. The angle of the aperture can be altered to any extent not less than 18°; a pointer travelling over a suitable scale showing in each case, not the angular measurement of the remaining effective aperture, but directly the corresponding factor by which the readings must be multiplied to eliminate the effect of the interruption.

The Polarization Photometer.

Dr. Krüss has attempted to use a polarizing arrangement in conjunction with the Lummer-Brodhun optical system, by fitting polarizing and analyzing nicols before the appropriate face of the double prism; the idea being that, by rotating the analyzer, the incident rays of light should be weakened to any desired extent. The plan exhibited two defects—firstly, that the loss of light in and at the surfaces of the nicols was serious; and, secondly, that the nicols had to be so large as to become extremely expensive, unless only such small radiants as the electric arc were to be tested. In another arrangement, the polarizing nicol was placed as before, but the analyzer was put in the telescope. This also failed, because the polarizing action did not extend over a sufficient area to cover the whole field of vision. The system of polarization, however, succeeds if the Lummer-Brodhun prism is replaced by a Glansche air-prism. Supposing the standard light at the left hand of the photometer-bar, a Glansche prism (polished on its front, back, and left sides) is placed in the path of the rays reflected from the right surface of the disc; the light being then polarized by the oblique air-film in the centre, so that the ordinary ray is reflected and the extraordinary ray transmitted. At a corresponding position on the left of the disc is a right-angled prism of Iceland spar, which polarizes the light from the standard burner in a similar fashion; the extraordinary ray being transmitted, and the ordinary ray reflected from its hypothenuse on to the diagonal of the Glansche prism, where it is again reflected into a direction parallel with the light from the other source. Hence the ordinary ray from the standard, and the extraordinary ray from the light under test, enter the observing tube side by side; and they are equal in brightness if the two sides of the disc are illuminated equally. Within the observing-tube is an analyzing nicol connected with a scale. When the nicol is in one position, the ordinary ray is suppressed entirely; and when it is rotated through an angle of 90°, the extraordinary ray suffers extinction. Therefore at an angle of 45° both rays reach the eye equal in brightness if they were equal before entering the nicol.

As the nicol is rotated, the strength of the ordinary ray (coming from the left, or standard burner) is reduced to an extent proportional to the square of the cosine of the angle of rotation; and that of the extraordinary ray (from the right, or burner to be tested) is reduced proportionally to the square of the sine. Hence, if both sides of the photometer-disc are illuminated equally, and the analyzer is moved through the angle x, the brightness of the left half of the field of vision is to that of the right half as 1 is to $\tan^2 x$. If the illumination of the disc is unequal, equality in the field is attained by rotating the nicol. In practice, the light under test is brought to a position on the photometer-bar where there is a convenient round number; then the analyzer is suitably rotated; the angle of rotation (x) is read off on the scale; and the reading of the bar is multiplied by the value $\tan^2 x$, which is calculated out once for all in tabular form for angles between 45° (= 1·00) and 90° (= infinity). The analyzer scale is graduated over a distance of 180° in the manner—90–45–90–45–90. High rotations are to be avoided, as the factor grows so rapidly; but they are not usually required, for a rotation through 81° diminishes the light to about one-fortieth of its original intensity. Two positions of the nicol can be found which give equality; and the mean of these should be taken. If the light under examination develops 1000-candle power or over, an intermediate standard, more powerful than the lamp emitting 1 Hefner unit, of (say) 50-candle power, may be employed in the operation.

The advantage of the polarization method is that the strength of the light can be reduced to any amount that may be desirable; whereas the former systems only allow of a reduction to one of several fixed sub-multiples of its original value. On the other hand, its use involves the preparation and consultation of a table. The employment of dispersing lenses, now to be considered, also permits the light to be diminished by one of several degrees, but involves the use of a simple table, unless the dioptric disperser which will be described afterwards is adopted.

The Action of Dispersing Lenses.

Before considering how the light from a high-power unit may be so diminished in intensity with the aid of lenses as to render it convenient for measurement on a photometer with a bar of ordinary length, attention must be bestowed upon the theory of the action of dispersing lenses as it has been elaborated by Perry and Ayrton. In the annexed figure, J is the source of light that is to be measured, SS_1 the photometer disc, and LM a convex or concave lens at the distance a from the light. The cone of rays, bounded by the lines JS and JS_1, is so refracted by the lens that

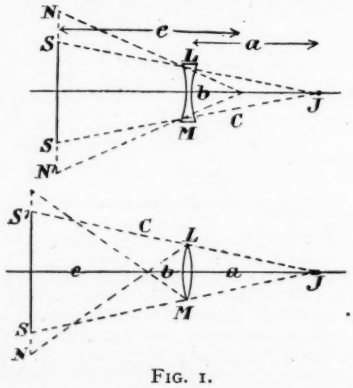


Fig. 1.

its apex appears to lie at the point C; the distance from C to the lens being b, and that from C to the disc being e. Hence the cone that appears to reach the disc is bounded by the lines CN and CN_1; and therefore the intensity of the illumination falling upon the disc when a lens is employed is diminished, from what it would otherwise be, in the ratio $SS_1^2 : NN_1^2$. Here, the loss of light by reflection from, and absorption in, the lens is ignored; but this error can be neutralized by Vollers' plan of placing a plane,

parallel piece of glass in the path of the rays approaching the opposite side of the disc.

Now, the surface of the lens receives an amount of illumination equal to $\frac{J}{a^2}$; or, since the light is focussed at C, and the illumination at C may be termed J^1, the light striking the lens is $\frac{J^1}{b^2}$. But since

$$\frac{J^1}{b^2} = \frac{J}{a^2}, \quad J^1 = J\frac{b^2}{a^2};$$

and therefore the illumination thrown by C upon the disc is

$$\frac{J^1}{e^2} = \frac{J}{e^2} \cdot \frac{b^2}{a^2}.$$

In order that both sides of the disc may be equally illuminated, the standard light J_0 must be at a distance equal to z;

$$\text{whence } \frac{J}{e^2} \cdot \frac{b^2}{a^2} = \frac{J_0}{z^2}, \text{ or } J = J_0 \frac{e^2}{z^2} \cdot \frac{a^2}{b^2}.$$

If the focal length of the lens is $\pm p$, the magnitude of b is fixed by the usual equation—

$$\frac{1}{b} = \frac{1}{p} - \frac{1}{a}, \text{ or } b = \frac{a\,p}{a - p};$$

p being negative in the case of a dispersing lens.

Conditions are different when the dimensions of the light sensibly exceed those of a point. In the following figure A B represents a Welsbach burner with a mantle glowing over a vertical height of

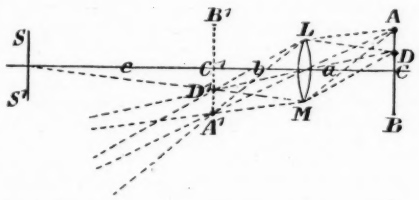


FIG. 2.

some 70 mm. [25 mm. are roughly equal to 1 inch], placed at a distance of 300 mm. from the convex lens L M, whose effective diameter is 50 mm., and whose focal length is 150 mm. At a distance, therefore, of 300 mm. away, the lens throws an image A^1 B^1 of the mantle in its natural size. In this case, $a = b$, and $J_0 = J\frac{e^2}{z^2}$; or, in other words, the intensity of the light reaching the two sides of the disc should apparently depend only upon the distances of the two sources. This, however, is not true. The figure shows that rays from A, which would reach the centre of the disc if no lens were present, cannot do so; for they travel onwards from A^1 in a direction bounded by prolongations of the lines L A^1 and M A^1. In fact, only a portion of the light emanating from the mantle arrives at the centre of the disc; the portion being defined by drawing lines from the centre of the disc to the edge of the lens, which cut the virtual image as at D^1, and by drawing lines from those spots on the image through the optical centre of the lens to the mantle, which meet it as at the point D. The extent of the mantle surface which thus illuminates the centre of the disc depends upon the distance between it and the lens.

Calling the distance between the mantle and the lens a, between the image of the light and the lens b, between the disc and the image e, calling the height C^1D^1 m, the height CD n, and the effective diameter of the lens o, we have—

$$\frac{m}{e} = \frac{\frac{1}{2}o}{e + b}, \text{ and } \frac{m}{n} = \frac{b}{a}; \text{ whence}$$

$$n = \frac{m\,a}{b} = \frac{e \cdot \frac{1}{2}o}{e + b} \cdot \frac{b}{a};$$

in which again $b = \frac{a\,p}{a - p}$, if p is the focal length of the lens.

In the particular case considered, $a = b$, or $\frac{a}{b} = 1$.

This expression is correct for the centre of the observing disc; but when experiments were made with a Lummer-Brodhun photometer, in which the central portion of the screen was illuminated with light coming through the lens, though the circular boundary

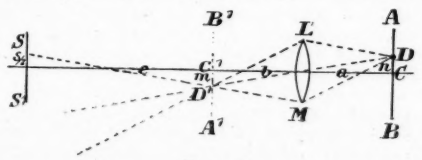


FIG. 3.

line between the two parts of the field could be made to disappear, it was found preferable to base the observations upon the portion of the disc lying in the immediate vicinity of the boundary. The state of affairs thus arising is shown in the subjoined diagram, where all non-essential matters are omitted, and where the path of those rays is indicated which finally strike the disc at the margin of the central area, whose diameter is s. Hence—

$$\frac{m + \frac{1}{2}s}{e} = \frac{\frac{1}{2}o}{e + b}, \text{ and } \frac{m}{n} = \frac{b}{a}, \text{ or}$$

$$n = \frac{o\,e - s(e + b)}{2(e + b)} \cdot \frac{a}{b}.$$

In a series of tests where s was equal to 10 mm., and the various distances had the absolute values already quoted, the mantle developed an illuminating power of 70·9 Hefner units; and therefore if its incandescence was equally bright all over, it evolved approximately 1 Hefner for each millimetre of its height. In the second vertical column of the following table are recorded the different illuminating powers observed on the disc when the distance between it and the optical image of the mantle (e) was increased from 50 to 150 cm. [20 to 60 inches]; whereas in the third column are the figures calculated for the height of the mantle, which, at the distance stated in the first column, should be casting light upon the screen:—

e Cm.	Hefners observed.	Active height of mantle calculated, mm.
50 ..	23·6 ..	23·8
75 ..	30·0 ..	30·0
100 ..	33·4 ..	33·8
125 ..	37·3 ..	36·4
150 ..	38·9 ..	37·2

The agreement is perfect. At the greatest working distance (5 feet) only about 55 per cent. of the vertical extent of the mantle threw light upon the disc. The maximum of active height (50 mm., or 71 per cent.) would reach a disc placed at an infinite distance from the image; for in that case MD^1 would be parallel to the optical axis, and m, n, and $\frac{1}{2}o$ would be all equal.

What has been said about convex lenses applies equally to such as have a double concave figure; and it shows that the simple theory covering the action of such lenses upon light issuing from a source having the dimensions of a point, as laid down by Perry and Ayrton, requires modification in practice. Corrections are requisite for the size of the luminous object, the effective diameter of the dispersing lens, and the ratio between the dimensions of the light and those of its virtual image.

An investigation was made into the effect produced by receiving the image of the light upon a sheet of ground or opal glass instead of allowing it to fall naturally upon the photometer disc. Pieces of ground glass of different degrees of fineness were tested, their translucency being first estimated by comparing the amount of illumination reaching a disc always placed at the same distance ($e = 100$) from a particular source of light when a glass was interposed in the beam with that arriving on the disc in its absence. In the following table, the first horizontal line shows the absolute amount of light received on a disc 100 cm. from the image of the light; while the subsequent lines represent the relative amounts reaching a disc at varying distances if that falling upon the disc 50 cm. away is called unity in each case:—

—	Without Glass.	Ground Glass. I.	Ground Glass. II.	Ground Glass. III.	Ground Glass. IV.	Opal Glass.
Actual light received ($e = 100$).	29·8	18·9	6·2	4·7	2·1	0·4
Relative brightness—						
$e = 50$	1·00	1·00	1·00	1·00	1·00	1·00
75	1·28	1·17	1·26	1·06	1·16	1·72
100	1·41	1·39	1·40	1·17	1·29	2·32
125	1·58	1·36	1·49	1·24	1·42	3·14
150	1·65	1·37	1·54	1·20	1·36	..

The figures in the first vertical column show the relative amount of light reaching a disc at different distances when no glass screen is employed; and therefore the figures in the later columns prove that the scattering action of ground and opal glass only partially interferes with the path of the rays determined by the lens. Moreover, the extent to which the ground glass scatters the impinging light does not depend solely upon its translucency, but upon other circumstances, and notably the character of the grain it bears. The opal (milk) glass behaves in a totally different fashion, and need not be further discussed beyond the observation that the angle at which the light falls upon its surface, and is radiated therefrom, seems to affect the result more seriously than might be expected to follow from Lambert's law.

In the practical employment of dispersing lenses for photometric purposes, it is only necessary to have such a relationship between the aperture of the lens and the size of the image it casts that the whole of the latter—*i.e.*, of the original source of light—becomes effective. This may be attained by increasing the diameter of the lens, or by decreasing the size of the image. The former plan is not to be recommended because of the expense, and the possible inferiority in action of a larger lens. The latter is the proper and natural object to achieve; for producing an image equal in size to the radiant, as shown in the previous figures, does not represent the conditions of practice.

In one of the experiments quoted above, only the light from 23·8 mm. of a 70 mm. mantle reached the screen at a distance of 50 cm. When the arrangement was altered so that the size

of the image was one-third (23·3 mm.) that of the mantle itself, the results of measuring the light at different distances against a 1 Hefner standard were as follows:—

e		z		J
50·4	..	18·8	..	68·4
75·4	..	28·0	..	68·4
100·4	..	37·5	..	68·4
125·4	..	46·0	..	69·6
150·4	..	54·5	..	71·6

The values for J are concordant, proving that all the light reached the screen at every distance. The mean value is 69·3; and since the illuminating power of the mantle measured without a lens was 84·3 Hefners, the transparency factor for the lens employed was 0·82. The accuracy of the method is also borne out by the results of examining a Nernst lamp, the incandescing body of which was 10 mm. long. Being so small, the lens was disposed in such a situation as to cast an image of equal size to the radiant, and the light was measured with or without one of the four pieces of ground glass already referred to. Taking the readings at 50 cm. distance as unity, the differences up to a distance of 150 cm. did not exceed ±0·06 (or 0·07).

(*To be continued.*)

GROWTH OF PRIVATE BILL LEGISLATION.

In the "JOURNAL" for the 23rd of January (p. 238), there was briefly noticed the Inaugural Address delivered by the Earl of Onslow, the Chairman of Committees of the House of Lords, in his capacity of President of the Royal Statistical Society for the current term, at the meeting of the Society the previous Tuesday. It may be remembered that his Lordship took as the subject of his discourse "The Rise and Development of Local Legislation by Private Bill," with which, it will be acknowledged, he was specially qualified to deal. The text of the address appears in the Society's "Journal" for the past quarter, with a copy of which we have been favoured by the Editors; and we therefore avail ourselves of the opportunity thus afforded of dealing more fully with his Lordship's remarks upon a branch of legislative work with which our readers are, of course, familiar, but of which the ordinary public know little.

It is regrettable, as Lord Onslow pointed out in his opening remarks, that the information possessed by the latter on a subject affecting the social well-being of the entire population of these islands is so small, and that they are consequently unaware of the way in which Parliament, "while encouraging private and municipal enterprise, endeavours to guard the community from the tyranny of monopoly, and to restrain within reasonable limits the expenditure and investment of the ratepayers' money." We may point out, in passing, that these words were spoken before the meeting of the new Parliament, and apply to the past. As to how near the truth they will be at the close of the present session, we need not stop to speculate. With the exception of Mr. Clifford's valuable work on "Private Bill Legislation," published twenty years ago, to which Lord Onslow acknowledges his indebtedness, there does not appear to be any book dealing specially with the subject; and certainly the statistics available are neither comprehensive nor easy of access. It may therefore be of interest to give a few of the particulars which the Lord Chairman has been able, with the assistance of Mr. Herbert Newbon, of the Inner Temple, to present to the members of the important Society of which he is for the time being the head.

In introducing his subject, Lord Onslow pointed out that Bills brought before Parliament, both public and private, have their origin in the ancient practice of petitioning the King for the redress of public or private grievances. No Private Bill may to this day be introduced into the House of Commons except upon petition. Petitions and grievances have for some 600 years been referred to bodies appointed by both Houses for their consideration. At the beginning of every session, the Commons appointed their Committee of Grievances; while since 1265 the Lords have appointed such Committees, the earliest being denominated "triers" appointed *pur oyer et trier* and *pur responder al peticions*. The history of our Local Bill Legislation is the history of the rise, development, and in some cases the decay, of the great industrial and commercial movements in England. The Statute Book tells us of local industries now departed, such as the iron-works of Kent, Surrey, and Sussex, where were manufactured cannon, culverines and falconets, cathedral railings, and agricultural implements, and the cloth-works of Kent. As each great subject of Private Bill Legislation has become obsolete, or been dealt with by general legislation, some new invention, or new requirement of advancing civilization, has provided material for the occupation of Parliament.

The first great subject of inland traffic seeking local legislation that engaged the attention of Parliament was for the construction of canals; and the most interesting scheme was that submitted by the Duke of Bridgewater for connecting Liverpool with Manchester, and for bringing his coal from Worsley to the latter city. It was over this project that was waged the first great parliamentary fight between an existing monopoly and a threatened rival—the Mersey and Irwell Navigation on the one side, and the Duke on the other. The parties to this struggle little thought that another, and far more dangerous, competitor to them both, as the carrying power of these islands, was about to appear. But it was really to the system of canals, thus initiated and subsequently developed, that we owe the introduction of railways; for the Trent Navigation Act of 1776 gave the promoters power to make a railway "for the conveyance of coals, stores, &c., to their limestone quarries at or near Caldon, so that no such rail way do exceed the length of 1000 yards." The earliest railway as now in use was authorized in the first year of the last century, from Wandsworth to Croydon, with collateral branches for the carriage of coal and merchandise; and in 1823, provision was made for the regulation of passenger traffic. After this date, the number of Bills deposited increased with great rapidity, till the so-called "railway mania" reached its height in 1846. In this year, no less than 453 Bills, the greater number being for railways, were passed. The next period of great activity in railway enterprise was in the years 1865 and 1866, when 382 and 377 Private Bills of all kinds received the Royal Assent, compared with 224 last session.

GAS AND WATER LEGISLATION.

Coming to the subject in which our readers are specially interested—the legislation in regard to the supply of gas and water—Lord Onslow remarks that the manufacture of gas for lighting purposes was early in the Nineteenth Century believed to be "rich in profits to those who were ready to undertake the lighting of streets and houses;" and he records how the Gaslight and Coke Company obtained in 1810, after an unsuccessful attempt the preceding year, an Act enabling them to light the streets of London, "but without any monopoly for breaking up the streets, or laying pipes for the purpose." From London, gas lighting spread to Exeter, then to Glasgow, and (by 1819) to many other towns, though we are told that "the danger of gas explosions somewhat retarded enterprise of this character." Without any intervening observation, Lord Onslow goes on to say: "In granting a monopoly to gas companies, Parliament took steps to protect the public against the possible extortions of those holding a statutory monopoly, by making provision that the prices charged by gas companies should fall in proportion as the dividends of the companies rose." As more than half-a-century elapsed between the granting of the Act in 1810 to the imposition of the restriction alluded to, it would have been well if it had been stated that this decision of Parliament was come to in 1875, in consequence of a proposal submitted by the Board of Trade to the Committee on the Metropolis Gas Bill of that year, on a suggestion by Mr. (now Sir) George Livesey—then an officer of one of the Companies concerned—for the adoption of the well-known sliding-scale of price and dividend. This obligation to make dividend depend on price, it is pointed out, has not been extended to companies supplying electricity for lighting purposes; but in their case power is conferred on the local authorities to buy them out at the expiration of 42 years, on terms which his Lordship says are "certainly not onerous."

With regard to water supply, Lord Onslow gives the following concise sketch of the progress of legislation in the Metropolis:—

> Those familiar with the history of the water supply of London will know that here, as well as in other cities, the obligation to supply water to the population rested on the Corporation, while private benefactions towards this object were not uncommon. But in 1543 it was found necessary to make application to Parliament for power to bring water from a distance, in words paraphrasing those at present in use in the preamble of every Private Bill: "Which good and profitable purpose cannot come to conclusion nor take good effect without the aid and consent of the King's Majesty and of this High Court of Parliament." Subsequently the Corporation, having obtained power to bring water from the New River, transferred their enterprise to Hugh Middleton, who, with the aid of King James the First, who furnished half the necessary funds, completed the enterprise which passed in 1619 to the New River Company. Various Bills were submitted to, and sanctioned by, Parliament; among others, one in 1721, to be carried out by the Chelsea Water-Works Company—the first of the great London Water Companies. Parliament having created these vested interests in the supply of water to the Metropolis, began, about the middle of the last century, at the instance of several Committees and Commissions, to consider the possibility of expropriating the Companies in favour of a public authority. The Metropolitan Board of Works, and subsequently the London County Council, attempted to achieve this end by competition, but were unable to obtain the consent of Parliament except after compensation paid to those holding the existing monopoly. An attempt was made by the Home Secretary in 1879 to acquire the Metropolitan Water Companies for London; but the attempt failed. In the end, a much larger sum had to be paid before the undertakings were vested in the present Water Board.

Another class of Private Bills which affect more closely the life, health, and persons of the dwellers in large cities are those promoted by corporations or other local authorities for the purpose of enabling them to carry out improvements. Lord Onslow thinks the provisions in these Bills, so far as they relate to sanitation and the maintenance of order, might properly be applied to all our larger towns by a Public Bill of the nature of the Public Health Act; but such is the congestion of public business in Parliament, that there is a disposition to increase annually by Private Bill the powers entrusted to the corporations of large cities. By requiring the same wording to be followed in each Bill, the law is rendered as similar as possible in all the large towns; and powers once conferred on one locality are not usually refused to others of similar importance. To illustrate the manner in which this class of legislation has increased in recent years, he points out

that powers are now given to those towns which have asked for them, and whose size seemed to justify their possession, to exercise control over the supply of milk, for the prevention of tuberculosis, for securing the purity of ice creams, for the prevention of infection from various causes, including the passage of books from hand to hand belonging to a lending library, and for the registration and inspection of lodging-houses. Corporations may provide town halls, public baths, and recreation grounds, and may contribute to bands to play there; they may license messengers and cattle drovers, and may take steps for the prevention of street betting, and to regulate sea bathing and bathing machines. The latest of the powers Parliament has conferred on municipalities relates to the supply of pasteurized milk, which is to be sold "in bottles just sufficient for a day's food supply for an infant, but not containing enough for the fond parent on his return from work to find sufficient left in the bottle to provide a drink for himself."

Lord Onslow shows in a striking way, in tabular form, the extent of Private Bill Legislation since 1871. In this period, 8516 Bills relating to the United Kingdom were introduced, and 6486 were passed. The Bills deposited for England and Wales largely outnumber those for Scotland and Ireland combined; being 81·49 per cent. of the total, as against 11·39 per cent. and 7·11 per cent. for Scotland and Ireland respectively. The number of English and Welsh Bills (989) deposited for the period 1901-5 was practically the same as the average (992) for the six previous quinquennial periods. The deposits of Scotch Bills have fluctuated considerably less than those of the other countries; and there has been a certain increase in the number since 1900, deposited as Provisional Orders under the Private Legislation Procedure (Scotland) Act, 1899, though possibly these may have included some matters which would otherwise have proceeded as Provisional Orders under the ordinary machinery arranged for this purpose. In the case of Ireland, there has been a marked decrease in deposits since 1880, with a period of particular depression from 1886 to 1889, during which, however, a larger proportion of the Bills became Acts than in any of the other similar periods. With regard generally to the Bills which became Acts, there is very little difference in the percentages for the separate countries; while the average for the United Kingdom is 76·16 per cent., or the equivalent of three chances to one in favour of any particular Bill becoming (though possibly with amendments) an Act.

In another table his Lordship classified the Bills deposited each session from 1861 to 1905. Grouped in decennial periods, the figures are as follows:—

—	1861-70.	1871-80.	1881-90.	1891-1900	1901-05 (Five Years).	Total Deposits 1861-1905.
Railways and canals	2332	1247	1108	791	209	5,747
Harbours, docks	145	157	175	134	49	660
Tramways	34	179	237	157	130	737
Gas, water, and electricity	516	505	310	495	299	2,125
Corporations	340	335	353	335	179	1,542
Miscellaneous	472	305	242	257	120	1,396
Scotch Bills	—	—	—	—	155	155
Total deposits	3839	2728	2425	2169	1201	12,362
Less railways	2332	1247	1108	791	292	—
	1507	1481	1317	1378	909	—

It will be seen that 12,362 Bills were deposited, of which 5770 were Railway Bills. If these are deducted from the total deposits, there has not been a very marked variation in the amount of Private Bill Legislation during the four decades; each having had one or two years of exceptional activity, often coupled with one year when, owing to the parliamentary situation and fears of a dissolution, the number of deposits was exceptionally light.

We now come to the portion of the address which dealt with Provisional Orders. Lord Onslow thinks that while, in all probability, the number of these Orders more than represents the number by which the Bills would have been increased had it not been for the introduction of this system in 1870, there can be no doubt that the deposits of Bills would have been larger had it not been in existence. In the first place, Orders are less expensive than Bills. Moreover, the intervention of a public department enables promoters and opponents to approach each other with a view to a compromise; whereas until they meet in the Committee-room this is difficult to bring about.

In the period extending from 1862 to 1905, the Board of Trade had 2556 Provisional Orders confirmed by Parliament, of which 575 related to the supply of gas and water. The other great issuing department is the Local Government Board, who have secured the confirmation of 3000 Orders from 1849 up to the present time. The general public do not realize the fact that—as Lord Onslow reminds them—every time they pay a toll or a fare, or the gas or water rate is collected, they are "contributing, in obedience to an Act of Parliament, to the earnings of local authorities or companies who have invested capital under statutory authority." To give some idea of the magnitude of these capital commitments, his Lordship reproduces some figures from the report of the Local Government Board for 1904-5, showing that the outstanding loans of local authorities amounted in the year 1902-3 to £175,119,645, of which £23,110,919 was in respect of gas, and £63,130,859 of water supply. The above-named total is but a small part of the entire capital of the various undertakings owing their existence to Private Bills, which reaches the large figure of £1,676,309,000, of which £80,869,000 represents gas. These vast issues for parliamentary undertakings have required more capital than the equivalent of the world's entire gold production for the Nineteenth Century, for which period the output is estimated at nearly £1,600,000,000. Lord Onslow points out, in this connection, that if the State were, as is sometimes advocated, to acquire at par the £1,268,494,681 invested in the railways of this country, it would add £29 per head of the population to the National Debt.

It may be of interest to conclude this notice of Lord Onslow's address by giving a few particulars from it which are incidental to the Private Bill business of Parliament. It appears that up to the year 1837, it was the practice of Parliament to appoint as Committees for the consideration of Private Bills a large number of members, including all those who were, either personally or in consequence of the electorates they represented, "interested in the measures before Parliament." In 1837, however, the House of Lords decided that Committees of that House should in future "act as a jury bound to give their decision according to the evidence." The next year, the House of Commons varied the system of appointing Committees; but they were still large—as many as 120 members sometimes serving upon one Committee. In consequence of the number of, and the divergence of interests in, the Railway Bills which then began to pour in, it was decided that these Bills should be referred to a Committee consisting of five members not interested in them; but as regards all others, the principle of not appointing to serve on Committees persons who were locally interested in the Bills was not applied till the year 1855. Up till 1849, Bills were not printed, but were engrossed on parchment, at great cost to the promoters, and an officer of the House of Commons was appointed to prepare a "breviate," or epitome, of each Bill. Lord Onslow thinks these "breviates" could have been rarely read or taken notice of by the members, for the system was abandoned in 1851. The evidence given before Committees, and recorded for the use of the parties and for subsequent reference, is naturally voluminous; and that taken before Committees of the House of Lords alone since 1835 occupies upwards of a million pages. The books and original Acts were fortunately saved from destruction by fire, when the Houses of Parliament were destroyed in the year 1834, by being loaded into carts and vans by members of the staff. They were conveyed to the premises of the owners of the vehicles, and afterwards repurchased as salvage, sewn up in calico bundles, and deposited in a ward of Westminster Hospital; the original Acts being placed for greater safety in the old Jewel Tower until the new buildings were ready for their reception. They are now lodged in the Victoria Tower.

Lord Onslow describes in detail the general procedure in regard to Private Bills, and traces the course of one that is opposed. He also explains how Provisional Orders are dealt with. Referring to the work of the Committees, he says it may be a matter of surprise to some that the decisions—which are those of men who do not of necessity possess judicial or expert knowledge, and are rarely reversed when an appeal is made to the whole House—can give satisfaction to promoters and opponents alike. Yet he tells us that "the most experienced Counsel and Agents, in their evidence before Select Committees, have given it as their opinion that no better tribunal could be devised to give satisfaction to all parties." The late Mr. Pope—a leading member of the Parliamentary Bar—stated that "he never heard any dissatisfaction expressed by anybody who had had much experience in the practice of parliamentary inquiry;" while Sir Ralph Littler said: "I have found in my experience that no sort of political influence has ever been known inside a Committee-room." With regard to the Parliamentary Agents, Lord Onslow says that, as a body, they are "conscientious and painstaking," and "act up to the expectation of Parliament and the officials of the House." Many suggestions have from time to time been made with the view of saving expense, either by confining opposition to a hearing before one Committee only, or by referring Bills to some permanent Commission. Those who are most competent to judge, however, adhere to the belief that the public interest might suffer if opportunity for opposing a Bill could be decided absolutely, and without appeal, by a single Committee or Commission. The number of second hearings is comparatively small—7 per cent. being a fair average. Sometimes the injurious features of a Bill are not apparent till it is in Committee in the first House, when it is too late to oppose. The petitioners, however, have obtained in the second House all the protection they needed. Lord Onslow cites the Thirlmere Water Bill of the Manchester Corporation, which in the first session was thrown out in the second House, but was re-introduced in an amended form in a subsequent session, and passed both Houses.

Summarizing the points of his address, Lord Onslow said he had endeavoured to show how great and varied are the interests, and how numerous the population affected by Private Bill Legislation; to give an idea of the magnitude of the capital, representing the savings of the nation, invested on the security of the authority of Parliament; and to help his audience to appreciate the time and labour gratuitously expended by members of both Houses of Parliament in hearing cases which, while involving in nearly every case questions of public policy, are yet judicial in their nature. He had drawn their attention to the manner in which, as soon as Parliament deals with one group of industrial

enterprises, the constant advance made by civilization and invention has provided fresh subjects for its consideration; and, finally, he had pointed out how, owing to the block in public business, much legislation that ought undoubtedly to be applied to the whole country, or at least to the great urban centres, has come to be enacted for one after another through the machinery of the local Private Bill.

COMBUSTION OF SOLID AND GASEOUS FUELS.

A paper was read by Herr Nauss, the Chemist to the Municipal gas undertaking at Breslau, before the last meeting of the Silesian and Lausatian Association of Gas and Water Engineers upon the above-mentioned subject; and having recently been printed in the "Journal für Gasbeleuchtung," we have extracted the following particulars from his communication.

Herr Nauss began by giving a number of experiments showing the various phenomena of gaseous and solid combustion, and with their aid he sketched the laws that govern the two different processes involved. As a rule the chemical combination between a fuel and the oxygen of the air does not commence in the cold, but only after a certain temperature has been attained by the reacting substances. Hydrogen, for instance, does not begin to burn below a temperature of 550° C. unless it is led over some catalyzing material, such as platinum black. In the latter case, however, it will combine with oxygen in the cold. Coal gas contains only some 50 per cent. of hydrogen, and therefore a cold mixture of it and air is not ignited by platinum black, unless the spongy material is placed in connection with fine platinum wires, which gradually acquire the necessary temperature to determine inflammation. A flame is only produced by the combustion of a body which yields combustible gases, or is itself converted into gas, when heated; other substances merely become incandescent. As a minimum temperature is required for the progress of a combustion, a flame can be partially or completely extinguished by plunging a cool body into it. In some of the earlier forms of gas-boiling apparatus, where the supply of primary air was so relatively small that the flame was tall, combustion was rendered imperfect by bringing a cold object (say, a kettle of water) into the flame; and hydrogen, carbon monoxide, and acetylene escaped unconsumed.

A constant amount of heat is liberated by the combustion of a certain quantity of a given fuel, whether it burns in air or in oxygen. The temperature of the flame is lower in air than in oxygen, because the nitrogen of the air has to be heated to the temperature of combustion, and because, increasing the size of the flame, its presence increases the proportion of heat lost by radiation, &c., into the surrounding atmosphere. Too restricted a supply of air to a flame reduces its temperature by imperfect combustion; too large a supply reduces it by providing an unnecessarily large amount of cold nitrogen and oxygen; and too slow a removal of the combustion products hinders the admission of fresh air to the flame. Solid fuels which burn to carbon dioxide and water vapour do not undergo complete combustion unless an excess of air is supplied to them; for otherwise a sufficiently intimate contact between the air and the solid fuel (or solid residue thereof) to ensure complete oxidation cannot be attained. With solid fuels such as coal, incomplete combustion involves a production of soot and smoke; but the result of burning coke incompletely is simply to produce carbon monoxide. On the other hand, a gaseous fuel can be consumed perfectly with hardly more than the theoretical proportion of air. If an incompletely carbonized coke is gasified in a producer, much tarry matter is evolved, which decomposes in the passages, and escapes as smoke from the shaft. The appearance of smoke can be prevented by increasing the secondary supply of air; but it is bad practice to dilute the products of combustion by admitting air into the flues in this manner. The owners of gas-works, especially when they are the local authority, ought to set a good example to the rest of the community in the matter of avoiding smoke production.

Herr Nauss next proceeded to show and discuss the well-known experiments proving that air will burn in gas as well as gas in air; that air burns in gas in the green inner flame of a bunsen burner; that luminous and non-luminous gas-flames consist of several portions which can be separated one from another; and that a gas which naturally gives a luminous flame yields a non-luminous flame if mixed with a certain proportion of air before being ignited. If, however, the proportion of air to gas in the mixture falls within certain limits, the said mixture becomes explosive, and is liable to fire-back within the burner from the proper point of ignition to the injector-jet. The limiting proportions of air to different gases which render the mixtures explosive have been put on record by Bunte, Eitner, and Trautwein; and the present author reproduces the table given by Eitner, some years ago, for gaseous mixtures contained in a tube 19 mm. in width.

This table may here be quoted in a different form, as follows, where the figures represent the largest and smallest proportions of air to one volume of combustible gas—the largest proportion corresponding with the lower explosive limit, and the smallest proportion with the upper explosive limit for the gas or vapour mentioned:—

Gas.	Volumes of Air per 1 Volume of Gas. Lower Limit.	Upper Limit.
Carbon monoxide	5·1	0·33
Hydrogen	9·6	0·51
Water gas	7·1	0·50
Acetylene	28·6	0·91
Coal gas	11·7	4·24
Ethylene	23·4	5·85
Alcohol	24·3	6·33
Methane	15·4	6·81
Ether	85·4	11·99
Benzol	36·7	14·38
Petroleum spirit	40·7	19·41

The figures recorded in this table are not universally applicable; but, being strictly comparable one with another, they are of great practical use. They indicate how explosions may be prevented in the manipulation of burners for gas and volatile liquids; how gas-engines should be designed; and how the combustions taking place in the latter should proceed. It is interesting to notice from the ordinary Eitner figures that the range over which mixtures of a certain gas or vapour and air are explosive, tend to be the wider as the gas or vapour requires a smaller volume of oxygen to consume it perfectly, and as the heat of combustion (per unit of volume) is less. The inferior explosive limit of acetylene gas is lower than that of other gases—approaching closely to the inferior limit of the vapours, although it requires so much less oxygen. This anomaly is due to the endothermic nature of acetylene. The limits for ordinary coal gas lie between 7·9 and 19·1 per cent. That is to say, that any mixture of coal gas and air containing between four and twelve times as much air as gas is explosive; 5·5 volumes of air being necessary for the complete combustion of 1 volume of coal gas. When using common coal gas atmospheric burners, not more than 3 volumes of air can be mixed with the gas without risk of firing-back; but in intensified burners a larger proportion of primary air can be used, because the mixture is either forced or aspirated through the burner-tube at a higher speed than usual—the higher forward speed compensating for the increased liability to fire-back, and giving a smaller and therefore hotter flame.

The following table represents the amount of oxygen required, the combustion products yielded, and the heat evolved by the single constituents of a coal gas of the composition stated. The figures in the last two columns have been recalculated from the metric data given by the author, and now represent large calories per cubic foot. The last column signifies the heat evolved if the water remains in the state of vapour; in the preceding column it is supposed to be liquefied.

Composition of Coal Gas.	Oxygen Required. Vols. per 1 Vol.	Oxygen Required. Actual Vols.	Combustion Products. Vols. H_2O.	Combustion Products. Vols. CO_2.	Heat Evolved. Gross.	Heat Evolved. Net.
H_2 = 0·47	0·5	0·235	0·47	—	40·8	34·5
CH_4 = 0·34	2·0	0·680	0·68	0·34	91·8	82·6
CO = 0·09	0·5	0·045	—	0·09	7·8	7·8
C_2H_4 = 0·47	3·0	0·120	0·08	0·08	15·7	15·1
C_6H_6 = 0·01	7·5	0·075	0·03	0·06	9·8	8·4
CO_2 = 0·02	—	—	—	—	—	—
N_2 = 0·03	—	—	—	—	—	—
Totals 1·00	—	1·155	1·26	0·57	165·9	148·4

If the combustion takes place in air, the 1·155 volumes of oxygen are accompanied by 4·345 volumes of nitrogen; and as the latter are mixed with the 0·03 volume present in the original gas, the total quantity of nitrogen in the combustion products is 4·375 volumes per 1 volume of coal gas burnt. Similarly, the 0·57 volume of carbon dioxide is increased by the 0·02 volume in the original gas, and the final total thus becomes 0·59 volume. Hence, after the separation of the water, the combustion products consist of 0·59 volume of carbonic acid, or 11·9 per cent., and 4·375 volumes of nitrogen, or 88·1 per cent. per 1 volume of the original coal gas.

Producer Gas.

When heating is effected by means of producer gas, the combustion of the carbon takes place in two stages. In the producer, the carbon meets with the primary supply of air, which is a mixture of 21 per cent. by volume of oxygen with 79 per cent. of nitrogen; and the carbon then yields 42 volumes of carbon monoxide mixed with 79 volumes of nitrogen or 121 volumes in all of producer gas containing 34·71 per cent. of carbonic oxide and 65·29 per cent. of nitrogen. Next, the 121 volumes of producer gas encounter more air of the normal composition, and give 42 volumes of carbon dioxide mixed with 158 volumes of nitrogen, or 200 volumes of combustion products containing 21 per cent. of carbonic acid and 79 per cent. of nitrogen. Within the producer the carbon first burns to carbon dioxide; the temperature of the fuel rising from the lowest layers to the spot where all the oxygen of the air is consumed in the formation of dioxide. Above that spot the carbon dioxide begins to be reduced by the excess of carbon into monoxide, and the temperature gradually falls again towards the top of the producer. The hotter the producer becomes, the lower is the hottest point in it. The formation of

carbon monoxide is encouraged by a high temperature (about 1000° C.), by long contact between the dioxide and the hot coke, by great depth of fuel, and by slow speed in the gas current.

Carbon monoxide only contains about 70 per cent. of the energy latent in carbon itself, as the annexed figures show. [These figures have also been recalculated into British data, except the heat units, which are left as large calories; 1 large calorie being roughly equal to 4 B.T.U.]

1 lb. carbon burnt to carbonic acid evolves 3672 large calories.
1 lb. carbon burnt to carbonic oxide evolves 1095 large calories.
0·0334 lb. carbon yields 1 cubic foot of carbonic oxide and emits 36·7 large calories.
0·0334 lb. carbon yields 1 cubic foot of carbonic acid and emits 123 large calories.
1 cubic foot of carbonic oxide yields 1 cubic foot of carbonic acid and emits 86·3 large calories.

The gases quit the producer at a temperature of about 900° C. (1652° Fahr.), and should be led as rapidly and directly as possible into the furnace. If the primary and secondary air supplies are warmed at the expense of the final combustion products, the economy of the whole process is raised by the amount of sensible heat recovered from these products.

An introduction of steam into the producer prevents the slag fusing together, and decreases the loss of heat by radiation, but alters the normal proportion between the primary and the secondary air supply. In the presence of steam, the carbon is partly converted into carbon monoxide at the expense of the oxygen in the water vapour, so that less primary air is needed. Hence a larger supply of secondary air is required; and as it can be heated up to about 1000° C. by means of the sensible heat in the final combustion products, that sensible heat is more perfectly utilized. Not more steam should be used than can be completely decomposed in the producer. In practice, however, this limit is often exceeded; 8 parts by weight of water being evaporated for each 10 parts of carbon gasified. The difference in the consumption of primary air brought about by blowing steam into a producer may be shown in the following manner: It will be remembered that 1 cubic foot of carbon monoxide, containing 0·0334 lb. of carbon, combines with 0·5 cubic foot of oxygen to yield 1 cubic foot of carbon dioxide; also that 100 cubic feet of air yield 43 cubic feet of carbon monoxide, or 2·38 cubic feet of air, containing 0·5 cubic foot of oxygen, and 1·88 cubic feet of nitrogen, yield 1 cubic foot of carbon monoxide. Now, in the absence of steam—

0·0334 lb. C. treated with 0·5 cubic foot O_2 (= 2·38 feet of air) yields 1 cubic foot of CO; and afterwards the

1 cubic foot of CO + 0·5 cubic foot O_2 yields 1 cubic foot of CO_2.

If steam is introduced and decomposed in the producer—

0·0334 lb. C. + 1 cubic foot H_2O vapour = 1 cubic foot CO + 1 foot H_2; and afterwards the

1 cubic foot CO + 1 cubic foot H_2 + 1 cubic foot O_2 = 1 cubic foot CO_2 (as before) + 1 cubic foot H_2O vapour (regenerated).

When a substance burns in air, the oxygen in the original air is wholly or partially replaced by carbon dioxide, carbon monoxide, and water; and the total proportion of oxygen in the combustion products is the same as in the air—viz., 21 per cent. It may be expressed thus—

$$O_2 = CO\% + \frac{H_2O\%}{2} + \frac{CO\%}{2} + O_2\% = 21.$$

If carbon is completely burnt to dioxide with the theoretically necessary amount of air, the combustion products contain 21 per cent. of combined oxygen. But if the fuel contains hydrogen, a part of the oxygen is consumed in the formation of water, which condenses at ordinary temperatures; and the sum of the carbon dioxide and oxygen in the combustion products never reaches 21 per cent. The same rule applies if the fuel contains oxygen as well as hydrogen. The more "available" hydrogen a fuel contains—*i.e.*, the more hydrogen in it combines with atmospheric oxygen—the lower is the total amount of carbon dioxide and oxygen in the combustion products. The following table shows the amount of carbon dioxide in the combustion products when the fuels mentioned are burnt with the theoretically required proportion of air:—

Pure carbon	21·0 per cent.
Coal (Saar)	18·6 ,,
Peat	20·4 ,,
Mineral oil	15·0 ,,
Coal gas	12·0 ,,

By determining the amount of nitrogen and oxygen in combustion products, the excess of air introduced into the fuel over and above that needed for perfect combustion can be calculated. As air contains 79 per cent. by volume of nitrogen and 21 per cent. of oxygen, the amount of nitrogen in the combustion products multiplied by $\frac{100}{79}$ gives the volume of air consumed in forming 100 volumes of those combustion products; and the amount of free oxygen multiplied by $\frac{100}{21}$ gives the volume of air per 100 volumes of combustion products which has not taken part in the combustion. Hence the volume of air used is—

$$n.\frac{100}{79} - o.\frac{100}{21};$$

and the excess is—

$$\frac{n\frac{100}{79}}{n.\frac{100}{79} - o.\frac{100}{21}} = \frac{1}{1 - \frac{o.79}{n.21}} = \frac{21}{21 - \frac{79\,o}{n}}.$$

When pure carbon is burnt, and the atmospheric oxygen is not consumed in oxidizing any other constituent in the fuel (as is practically the case with coke), the excess of air employed may be calculated from the formula $\frac{21}{CO_2\%}$.

If the heat of combustion (H) of a fuel, and the heat capacity (C) of the combustion products are known, the temperature of combustion is—

$$T = \frac{H}{C}.$$

If the combustion products pass away at a temperature of $t°$, the loss of heat (L) so caused is—

$$L = \frac{t}{T} \times 100;$$

and the useful heat (U) is—

$$U = \frac{T - t}{T} \times 100.$$

The useful heat is proportionately the greater, the smaller the excess of air entering the furnace, the nearer the amount of carbon dioxide in the combustion products is to the theoretical, and the lower the temperature at which the products pass away.

GENERATION AND USE OF ACETYLENE.

At a Meeting of the Association of Engineers in Charge last Wednesday, a paper on "The Origin and Progress of Acetylene, and its Adaptability to Various Uses," was read by Sir CHARLES S. FORBES, Bart., who, it will be remembered, is President of the Acetylene Association, and is in other ways closely identified with the industry. The communication, which was of a lengthy character, was illustrated by a number of lantern views, which were useful in elucidating points that would otherwise, to some of those present, have been doubtless more difficult to understand. The chair was taken by Mr. W. H. Booth.

In his opening remarks, the author pointed out that acetylene had been known to chemists for a great many years, and was originally produced in the laboratory by Edmund Day in 1836. The gas was first known by the name of ethine; but it did not become a commercial article until the discovery of calcium carbide—in America by Mr. Willson, and in France by MM. Moissan and Bullier. A considerable portion of the success of the acetylene industry to-day depended on the economical production of calcium carbide, which was at present made by delivering powdered quicklime and either powdered coke or charcoal or anthracite coal into an electric furnace, the temperature of which was about 2000° C. To produce this temperature electrically entailed the employment of considerable power. Hence the necessity for cheap power was so pressing that water power was the only means by which it was at present possible to make carbide of calcium at a sufficiently low cost to be commercially saleable. After referring to the furnaces used for the manufacture of the carbide, he passed on to the generation of acetylene gas; remarking that the action of water upon carbide was extremely rapid, and gave rise, unless in some way controlled, to a great deal of heat. Properly designed acetylene generators must therefore be so constructed as to get rid of the heat as formed, in order not to allow the temperature of the gas to become excessively high. If this were not done, the gas was split up into other compounds. The regulations of the Acetylene Association were to the effect that the gas, before leaving the generator, must not be of a higher temperature than the boiling-point of water; and the Home Office insisted that it must not be stored at a higher pressure than that of a column of water 20 inches high. The author then described the various types of generators, which he classified for this purpose as follows: (1) Automatic generators with carbide in excess; (2) automatic generators with water in excess, where the water is made to rise up under and attack the carbide; (3) non-automatic generators with water in excess, where the water is made to rise up and attack the carbide; (4) non-automatic carbide-to-water generators, with water in excess; and (5) automatic carbide-to-water generators, with water in excess. Allusion was also made to the Atkins dry process, in which, instead of employing water for the generation of the gas, use is made of powdered washing soda, which is mixed with granulated carbide in an apparatus closely resembling a barrel-churn, the handle of which is turned round and the gas gradually generated and stored for use in the holder. In this case, it was claimed that a bye-product was produced which was valuable and saleable; but he (Sir Charles) had not had an opportunity of verifying or checking the statement. No systematic method had yet been adopted for the disposal of residues from acetylene generators; but when this was done (as no doubt it would be some day) the cost of the gas would, of course, be less.

This brought the author to the question of cost, a point, however, on which he had not very much to say. He remarked

that a great many comparative tables of the cost of acetylene and other forms of illuminants had been prepared; but he had never found two that agreed. He therefore preferred to leave comparative cost out of the question for the moment—seeing that circumstances altered cases so very much—and contented himself with giving the actual cost of a standard burner per hour under given circumstances. Once having installed an acetylene gas plant, he said, the wear and tear and labour necessary were negligible quantities—always supposing proper plant was used. As the basis of his calculation, he took a burner using ½ cubic foot an hour, and reckoned that good carbide (which should yield an average of 4·75 cubic feet of gas per pound) could be delivered at £17 per ton. With these data, he worked out that a ½ foot burner would cost 0·191225d. per hour for carbide only. This was less than ⅕d. per hour; and, allowing something for labour and repairs, ¼d. per hour would represent the cost of a very fine light. It was, however, possible to employ burners consuming half this amount of gas; but he generally found that people—at least in country houses—were inclined to go on increasing the size of their burners. Very often, after the consumer had doubled or trebled the power of his burners all over his house, he would complain to the generator maker about the cost of the light. The answer to this, of course, was that the estimate of cost was for the equivalent of the light he had before.

Passing to the question of pipes and fittings, the author said, as the amount of gas used in an acetylene burner was less in proportion to the light given than in the case of other gas, it would appear, at first sight, as if much smaller pipes were necessary. It was a mistake, however, to run the main pipes in a building too small, though the service-pipes to the burners themselves could, if required, be left as small as ⅛ inch for a short distance. In no case should anything but iron pipes be used in a house—except, of course, where brass was employed for the sake of appearance. Compo. pipe was not to be recommended, owing to its liability to mechanical damage. In the fittings, great care should be taken to see that the cocks and joints were all well ground in, and had plenty of bearing surface; any bad work would result in annoyance. Special attention was drawn to the acetylene burner introduced by Messrs. Geo. Bray and Co., which allows of the flame being turned down without any choking from carbon resulting. Touching upon incandescent acetylene lighting, Sir Charles said that, so far as his short experience went, he could not get the mantles to last more than a few days, as when lighting the gas they were apt to break. At present he was afraid that acetylene could not compare favourably in cost for cooking purposes with gas or oil; but it was, of course, much cheaper for this purpose than electricity. There had, however, lately been a very important development in the use of acetylene for welding, owing to the introduction of an oxygen blow-pipe invented by M. Fouché, of Paris. The results obtainable in welding iron and steel with this process were, he said, nothing short of marvellous. Acetylene could, he concluded, easily be employed for driving gas-engines. Acetylene for power purposes was, however, as at present used, distinctly expensive; and for this reason, he would advocate the adoption of electric ignition instead of the tube, since, so far as he could see, the bunsen burner for the tube would consume as much gas as would drive a fair-sized engine.

The paper was followed by a brief discussion, in the course of which Mr. F. S. Thorn referred to the question of the use of incandescent mantles with acetylene. He said that with the bursting of a mantle the expense of a new one was not the only trouble; another result was that everything in the room was in a very few moments covered with lampblack or soot in its worst form. Another speaker, Mr. Horace Allen, said that in using acetylene the first difficulty met with was in opening the receptacle containing the calcium carbide. This could not be done near an inhabited room. Then, again, there was the trouble of getting rid of the refuse. Sir Charles Forbes, in replying to points that had been raised, said his reason for claiming that acetylene was a better light than electricity, was that his lady friends said they could not see properly with electricity, and that they could with acetylene. The incandescent electric lamp was very trying to the eyes unless the right pressure was on; but if the correct pressure could be always maintained, it was, of course, extremely good and convenient. He maintained that the pipes would not get clogged up with acetylene if the gas was properly purified. If, however, there was overheating, and the gas was taken through the pipes without purification, the pipes and burners would be troubled in this way. He had known burners to run for four years without being cleaned.

A vote of thanks was accorded to the author for his paper.

The Last Year's Working of the Paris Gas Company.—At a recent general meeting of the shareholders of the Paris Gas Company, the Liquidators presented a report on the working during the past year—the last in the existence of the undertaking. It showed that the revenue amounted to £5,247,125, and the expenditure to £3,435,148; leaving a balance of £1,811,977. Adding £15,999 brought forward, the total is £1,827,976. A sum of £553,924 will be paid into the City Exchequer on account; and the shareholders have at their disposal £1,139,711, which is subject to certain deductions. There is sufficient, however, to allow of the payment of a dividend of 61 frs.; making, with the usual interim dividend of 12 frs. 50 c. paid in October, 73 frs. 50 c. (£2 18s. 6d.) per share.

COPPER-IRON SULPHATE FOR THE PURIFICATION OF WATER.

The water supply of Marietta (Ohio) is drawn from the Ohio River through two suction-pipes running out to mid-channel. Each ends in a 15-feet length of wrought-iron pipe perforated with about 30,000 holes ¼ inch in diameter. The excessive occasional turbidity of the water is indicated by the fact that when the river is in flood the orifices in these pipes stop up rapidly, and have to be cleared by back-flushing. The water is raised by centrifugal pumps to the forebay of the purification works, and the great variation in the elevation of the river surface has rendered the operation of the pumping plant rather unsatisfactory at times. The pumps deliver the raw water to the forebay through a balanced valve controlled by a float. The forebay holds 31,600 gallons, and from it the water passes directly to two sedimentation basins, one holding 182,850 gallons, and the other 258,750 gallons. A flume conveys the water from the settling-basins to the filters, of which there are eight, each 10 ft. by 20 ft., and housed in a 53 ft. by 124 ft. 6 in. reinforced concrete building. The eight filters are rated at 4 million gallons per day, and when operating at this rate their yield is rather less than 109 million gallons per acre. Each filter has a controller by which its rate of operation can be changed instantly from the working floor. The filtered water is stored in a clear-water reservoir below the filters, from which it is pumped to the city. The filters were guaranteed by the builders to furnish 4 million gallons of filtered water daily, to remove 98 per cent. of the bacteria in the applied water when the number in the river water averaged 3500 per cubic centimetre, and to reduce the bacteria in the filtered water to less than 75 per cubic centimetre when the river water had less than 3500 in this quantity. The works were built to enable either alum or sulphate of iron to be used as a coagulant. The official tests for the Board of Public Service were made by Professor Monfort and Mr. C. A. Brown; and they are of special interest on account of the use of copper-iron sulphate as a coagulant while they were in progress. The following particulars concerning the tests and their results are taken from some extracts from Mr. Brown's report given in a recent number of "Engineering Record."

There are four reinforced concrete chemical tanks, two 9500-gallon tanks for lime, and two 5000-gallon tanks for the sulphate of iron and copper. The lime was slaked in a special box, using hot water. After cold water was placed in the box, steam was turned on and the water raised to 150° Fahr. The lime was then added, and after it was slaked it was flushed into the storage-tanks. With a lime solution carrying 210 grains per gallon, two and sometimes three tanks of lime had to be made up each day. A duplex pump set over the tanks lifts the milk of lime to a head tank under the roof of the chemical-room, and an overflow-pipe leads from it back to the lime storage-tanks. The pump constantly delivers more milk of lime to the head tank than is used, and the superfluous amount returns through the overflow-pipe to the storage-tanks, agitating their contents, and thus assisting in maintaining a homogeneous solution of equal strength. The sulphate of iron and copper dissolve readily; and it was only necessary to place it in a box above the two iron storage-tanks and allow a stream of water to pass through it. In making up the iron solution, enough sulphate was used to give a chemical strength equal to 1204 grains of sulphate of iron to the gallon. When the water was at its worst, this strength was doubled. Only one tank of iron solution daily was needed. The iron solution passes by gravity from the storage-tank through a 2-inch pipe to a constant head and orifice box, placed just above the centrifugal pumps, and is discharged into the suction of the latter.

When sulphate of copper or sulphate of iron in solution is added in small quantities to a natural water, a partial coagulation occurs; but the reaction is incomplete, and all the iron or copper is not removed from the water, even if it is allowed to pass through a mechanical filter at a slow speed. But if sufficient caustic lime is added to absorb all the free, and a small part of the semi-combined, carbonic acid, the chemical reaction takes place almost instantaneously, and a perfect coagulation results if the chemicals have been used in sufficient quantity. Under these conditions, the removal of the iron is very complete, and the filtered water will usually show less iron than the raw water does. The removal of copper sulphate is equally complete.

It has been found by experiment that 1 part of copper sulphate dissolved in 100,000 parts of water will destroy the colon and typhoid bacteria in the latter. To treat a public water supply at this rate would cost about 17s. per million gallons for chemicals alone; and as little clarification is effected by this amount of copper sulphate, the process is obviously unsuited for continuous use in connection with filtration or sedimentation. Laboratory experiments had convinced Mr. Brown, however, that the amount of copper could be materially reduced and still enable satisfactory results to be obtained. If sulphate of copper was precipitated with caustic lime and held on a filter, it was found that a natural water could, without further treatment, be contaminated with cultures of typhoid and colon bacteria; and by passage through the filter containing the precipitated copper a material reduction in the bacteria was effected over and above what could be attributed to the filter unassisted by the copper. Hence it was

believed that the time apparently required for the destruction of bacteria by the copper process was not that needed for the copper to remain in contact with the bacteria, but that required for it to get into contact.

In the Marietta tests, the lime used came from Marion, and, in addition to containing considerable magnesia, was very rocky. The copper-iron sulphate was in the form of crystals of about the same size as the grains of granulated sugar. The 1 per cent. of sulphate of copper was incorporated with the 99 per cent. of sulphate of iron in such a way as to have a perfectly homogeneous and uniform distribution throughout the mass. The tests began on May 16, and ended on May 30, 1905; and eleven runs were made in this time. The average results were as follows: Bacteria in river water, 1913 per c.c.; in settling-basins, 258; in filtered water, 12; turbidity of river water, 305; of filtered water, *nil;* colour of filtered water, 6. The average efficiency of the plant in removing bacteria was 99·33 per cent. for the fifteen days. Out of 228 filter samples taken during the test, 32 proved sterile, and 41 contained only 2 bacteria per cubic centimetre. Out of 31 river samples taken, the colon bacillus was found in 20; in an equal number of samples from the effluent of the sedimentation basins only three contained it, and there were none in the samples of filtered water.

The maximum amount of iron sulphate was 3·84 grains per gallon of water treated; the minimum, 1·13 grains; and the average, 1·94 grains. The maximum amount of lime used was 2·91 grains; the minimum, 0·38 grain; and the average, 1·25 grains. The chemical cost ranged from 4s. 4d. to 15s. 6d. per million gallons of water filtered, averaging 8s. This is based on copper-iron sulphate at £2 5s. 10d. per ton and caustic lime at £1 5s. When straight iron sulphate or alum is used as a coagulant, there are no apparent germicidal properties manifested by the chemicals; and any removal of bacteria that occurs is probably brought about in a mechanical way, and not because of any selective germicidal properties of the chemicals used. With copper sulphate, Mr. Brown asserts, the case is different. It acts as a germicide to certain species of bacteria when used in very dilute solutions, while other species are not affected. The species that are most easily killed are those of the colon and typhoid groups, which it is most desirable to remove from water.

As there has been some criticism of the use of any copper sulphate addition to water intended for domestic purposes, a number of tests were made at Marietta to determine whether, after the filtration, any copper remained in the water in excess of what was in the raw water. For this purpose 200 gallons of river water and the same quantity of filtered water were evaporated to dryness. From the river water a residue weighing 750 grammes was obtained, and from the filtered water one of 71 grammes. To these residues were added chemically pure sulphuric acid of 1·84 specific gravity, and both were heated until all fumes of sulphuric anhydride ceased to be evolved. Dilute acid was then added to extract the residues, and each was subjected to electrolysis. The copper thus obtained was re-electrolyzed from dilute nitric acid. From the 200 gallons of river water was obtained 0·10015 gramme of metallic copper, and from the filtered water 0·00275 gramme. These amounts, when converted into grains per gallon, gave 0·00772 grain for the river water and 0·0002 grain for the filtered water. At the time the 200-gallon sample of filtered water was taken, 1·6 grains of copper-iron sulphate were being used as a coagulant. This is equivalent to 0·0041 grain of metallic copper per gallon of water. Adding this amount to that in the raw river water gave 0·0118 grain of metallic copper to be removed by the filters. On this basis, the amount removed was equal to 98·3 per cent. The finding of even so small an amount of metallic copper as 0·0002 grain in the filtered water was something of a surprise to the chemists in charge of the tests, and subsequent experiments were carried through which indicate that it came from various brass and copper fittings through which the water passed. The copper in the raw river water has no germicidal effect, because it is present in an insoluble form, probably an oxide.

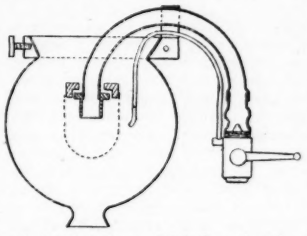
The Junior Institution of Engineers will on Saturday, the 28th inst., at 3 p.m., visit the works of the Croydon Gas Company, at Waddon.

The Perkin Memorial Fund.—Our readers may remember that, as the result of a public meeting held at the Mansion House on the 26th of February, which was reported in the "JOURNAL" at the time, an appeal is being made for contributions to a memorial in honour of Dr. Perkin, who, at the age of eighteen—fifty years ago—discovered the dye-stuff mauve, and laid the foundation of the coal-tar colour industry, the development of which has exerted a large influence upon the entire chemical trade of the world. At the meeting referred to, a Committee was appointed, and it was decided that subscriptions should be invited to carry out the following objects: (1) The presentation to Dr. Perkin for his lifetime of an oil portrait of himself; the portrait to become the property of the nation at his death. (2) The execution of a marble bust, to be placed in the rooms of the Chemical Society. (3) The establishment of a "Perkin Research Fund," for the promotion of chemical research, to be administered through the Chemical Society. Subscriptions in aid of these objects will be received by Messrs. Robarts, Lubbock, and Co., No. 15, Lombard Street, London.

REGISTER OF PATENTS.

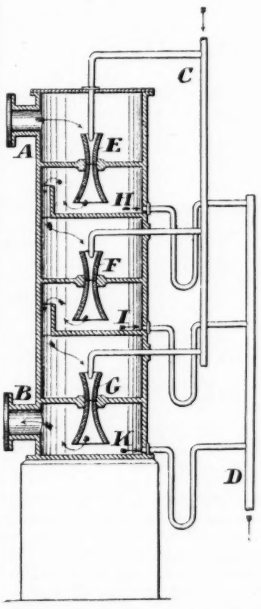
Incandescent Burners.—Carley, A. T., of East Sheen, Surrey. No. 2322; Feb. 6, 1905.

The object of this invention is to produce an inverted incandescent burner in which the bent tube is as short as possible, and in which, consequently, the highest part of the bend is in proximity to the globe ring; and the space between the globe ring and the burner-tube above the mantle is made as open as possible. For this purpose the globe ring is attached (as shown) to the burner-tube by a clip outside the ring, or the globe ring may be supported by wires—the object being to leave the space within the globe ring as open as possible "for the free and uniform exit of the gases of combustion." Further, the burner has a bye-pass tube and cock for lighting. This has already been tried, the patentee remarks; but "there has hitherto been a difficulty with some types of inverted burners, owing to the fact that the small jet would not burn properly, because the bye-pass tap or cock, being above the flame, became heated, and when cooled it affected the amount of opening in the plug of the tap, whereby the pilot flame was very often extinguished."



Washing or Purifying Coal Gas.—Ott, E., of Zürich, Switzerland. No. 5773; March 18, 1905.

The patentee states that he has found that, for getting rid of the sulphuretted hydrogen contained in coal gas, it is not sufficient to produce a good absorption of the impurity by the water used for washing—especially if the latter contains ammonia, as is usual in gas-works—but to adopt special precautions for preventing the re-absorption of the sulphuretted hydrogen by the gas, which may be effected by separating the washing water from the gas as rapidly as possible after the washing process. He has also found that an ordinary spray producer—such as is used in some of the earlier apparatus—is much inferior to an injector, as a means for producing an intimate mixture and thorough absorption.



For rapidly separating the mixture of water and gas which has passed through an injector, he causes the jet of liquid to impinge against a baffle-plate or deflecting surface placed a short distance from the outlet of the injector, approximately at right angles to it, and then allow the water to flow out of reach of the gas on the shortest or quickest way, so as to reduce as far as possible the duration of its contact with the gas. The baffle-plate is preferably the bottom of the mixing-chamber. In the example of apparatus shown, fresh washing liquid is supplied for every washing operation from a common source. This washing liquid is supplied to the apparatus at C, and discharged at D. It is under pressure, produced either by its fall from a high-level reservoir or by pumps. It is distributed by branch pipes to suction and distributing nozzles E, F, G, and forced through them, while either drawing in and compressing or absorbing the gas which enters at A. By their passage through the nozzles, and also by impact with the bottom or partition provided underneath each nozzle, the liquid and gas are intimately mixed and vigorous mechanical action is ensured. The washing liquid which has passed through the nozzles collects at the bottom, and is discharged sideways in the direction of the arrow H, I, K, so that the time during which the gas and any given quantity of washing liquid remain in contact will be reduced to a minimum.

The gas drawn into the nozzle E mixes with the washing liquid, and after having passed through it, and then separated from the liquid, it is drawn into the nozzle F, where it is washed a second time with a fresh supply of washing liquid.

Two or more nozzles may, of course, be arranged side by side—that is to say, on the same level; and the entire apparatus can be arranged horizontally, instead of vertically. In the vertical apparatus, the gas may also be caused to ascend finally through a high column of liquid for completing the purification.

Elevator and Conveyor Chains.—West, John, of Manchester. No. 15,309; July 25, 1905.

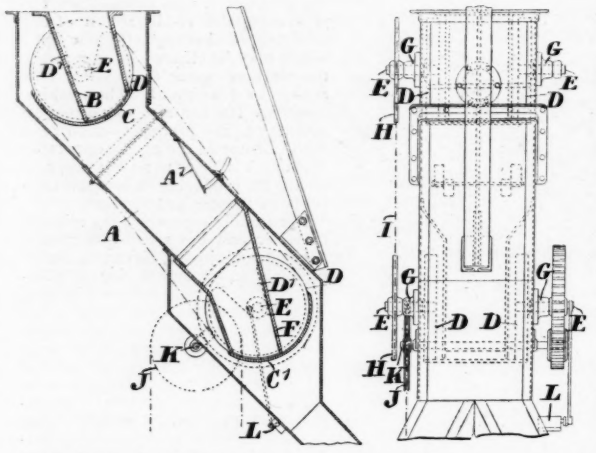
This invention has for its object the construction of drive, elevator, and conveyor chain links in such a way that separate joint-pins are dispensed with—the joint-pins being made in one piece with the side links of the chain; also the construction of the block links of the chain so that when it is put together the side links are kept in position by snugs formed on the sides of the block links. The chain is so designed that the links may be taken apart when the side links are placed at right angles with the block links.

To effect this, the side links of the chain are formed with bosses to take the place of the ordinary loose pins for connecting the chain together. The side links are separate from each other, and when in the block links the bosses on the side links meet in the centre. Snugs are formed on the block link sides so as to hold the side links in position; and they are so arranged that the links may be put together or disconnected when at right angles with the block links.

Measuring and Delivering Coal to Retorts, &c.—Edgar Allen and Co., Limited, and James, C. W., of Sheffield. No. 18,029; Sept. 6, 1905.

Although this invention is applicable for a variety of materials, a description of it as applied to the measuring and delivering of coal to gas-retorts will suffice. As ordinarily constructed, such apparatus consists of a closed shoot, the upper end formed with a chamber of given capacity, provided with sliding doors at both ends, and placed below a hopper. The lower end of the measuring box leads into a delivery box, and thence through the shoot to the retort mouth. Apparatus of this type usually allows of the escape of quantities of coal dust, in consequence of the difficulty of preventing the leakage which almost invariably takes place through the sliding doors; and the object of the present invention is to obviate this defect, and to provide means of opening and closing the measuring box so as to do away with leakage from this cause.

Immediately above the measuring-box A is a tapered mouthpiece B, the lower orifice of which is provided with a semi-cylindrical shutter or slide C. The edges of the orifice of the mouthpiece are formed to the same radius as the semi-cylindrical shutter, which is supported by two semi-circular ends D, provided with weights D^1 (to balance the shutter), carried upon suitably placed spindles or trunnions. Immediately below the measuring-box is a discharging port F, provided with a precisely similar orifice and semi-cylindrical shutter C^1 to that previously described. The spindles on which these shutters are actuated project through bushes or bearings G to the outside of the casing; each being provided with a wheel H of the same diameter, and connected together by a pitch chain I. The wheels are actuated by another chain-wheel J, on the same shaft or on a second motion shaft K, geared up as may be required.



In this way, when the hand chain-wheel J is worked, both the shutters C C^1 at the top and bottom of the measuring-box are simultaneously moved; but the shutters are provided with sufficient lap—the upper one on one side, and the lower one on the opposite side—so that in the ordinary condition of working, although both orifices may be closed at the same time, they cannot be opened at the same time, as when it is de sired to open the top orifice to fill the measuring box while the shutter C is opening on the inlet orifice, the shutter C^1 on the outlet orifice has a ufficient length of lap to keep that oriffice closed until the upper orifice is fully opened; and before the lower orifice can be opened, the upper orifice must in the same way be fully closed—the lap on its shutter being sufficient to keep it closed, while the lower orifice becomes fully open, and *vice versa*.

The measuring capacity of the apparatus consists of the cubical contents of the box A, below the orifice in the tapered mouthpiece B, together with the cubical contents of the discharging port F above the shutter C^1. The measuring capacity may be varied by a moveable shutter A^1, placed within the measuring-box, as described; and a record of the number of times the measuring box is filled and emptied may be taken by means of a counter L.

As this particular form of shutter allows the whole of the moving parts except the spindles to be enclosed in the casing of the shoot, there is no leakage of dust to the outside of the casing.

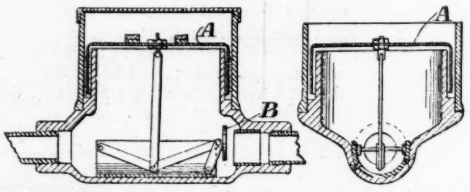
Controlling Devices for Gas-Stoves.—Schofield, W. B., of Merchantville, N.J., U.S.A. No. 18,910; Sept. 19, 1905.

This invention relates to automatic controlling devices for gas-stoves and the like, in which a valve to control the fuel supply to the burner is operated by a primary actuating device—such as a lever—actuated by a vessel placed upon the stove, whereby the placing of the vessel in position automatically turns on the gas to the burner, and the gas is automatically turned off when the vessel is removed. In such devices, the operation of the primary actuating device turns on the full head of gas; but an auxiliary hand operates to control the valve so that the supply may be regulated to suit requirements without interfering with the automatically controlled valve. Also, as it is desirable that the full head should always be turned on at first, means are provided whereby the auxiliary hand-controlled valve will be automatically returned to its normal full position with reference to the main automatic valve when this valve is opened or closed. The auxiliary valve which controls the main valve is carried by the latter and moves with it; and if the auxiliary valve has been moved into an intermediate position to reduce the flow of gas, the automatic valve, in returning to either the open or closed position, moves the auxiliary valve back only sufficiently to bring it again into full register with the port of the main automatic valve, so that when the main valve is again actuated by the primary actuating part the full head of gas is turned on.

The invention also relates to igniting devices, whereby the ignition is rendered more certain, and the sparking may be controlled by the flame so as to continue until the flame has acted thermostatically upon the sparking points.

Gas-Pressure Regulator.—Weeks, J. W., of Providence, R.I., U.S.A. No. 21,559; Oct. 23, 1905.

This automatic pressure regulator comprises (as shown) a casing having an inlet and an outlet, a swinging member pivotally supported in a frame in the bottom of the casing, toggle members connected to the swinging member, a valve pivoted to the free end of the swinging member so as to give the valve a wiping contact on its seat, a bell fitting over the top of the casing, and a connecting member extending from the toggle members to the bell.



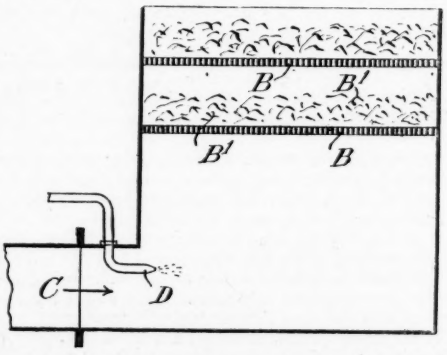
The regulator is intended to be inserted in the supply pipe between the meter and the burners. The bell A rises and falls freely in an annular groove sealed by mercury, and is connected so as to operate the swinging valve B through the toggle-joint arrangement against the pressure of the gas. When all of the burners are closed, the pressure forces up the bell, and the valve is carried over against its seat and shuts off the supply of gas. When a burner is lighted, the bell falls slightly and opens the valve just enough to admit the proper quantity of gas to flow in; when two burners are lighted, it falls lower and admits a greater quantity; and so on, until all of the burners are lighted. Weights are placed on the bell to regulate the supply.

Mantles for Inverted Incandescent Lamps.—Henze, A., of Charlottenburg, Germany. No. 24,584; Nov. 28, 1905.

This invention consists in making the head of the mantle curved or tapered downwards in such a manner that no pleats or ridges are formed—the tubular knitted part of the mantle gradually decreasing in size downwards until it is entirely closed. In this way the radiant surface remains as even as possible; the rounded part can, in addition, be knitted with double thread to render it stronger. Every unevenness in the incandescent part, the patentee points out, reduces the lighting power, through the projecting parts producing shadows; and in inverted lamps it is of importance that the head thoroughly and entirely incandesces, as it is the source from which the light radiates to all parts. The strengthening of the head—in addition to rendering the mantle more durable—serves to increase the number of incandescent particles.

Treating Spent Oxide from Gas-Purifiers to Revivify and Render same Fit for Re-use.—Browne, A. F., of Vauxhall Gas-Works. No. 26,899; Dec. 23, 1905.

It has been formerly proposed, the patentee remarks, to revivify the spent oxide in the gas-purifiers by treating it *in situ* by blowing air into the purifier without removing the oxide. But this was accompanied by liability of the oxide to heat and render the operation dangerous; and to meet this and other difficulties, it has been proposed to inject into the purifiers an air-blast by the aid of a steam-jet. This method, however, is also open to objection, as the steam continuously injected



would be liable to reduce the oxide to such a wet condition as to impair its usefulness. It has also been proposed to remove the oxide from the purifiers and subject it to the action of air in separate receptacles by passing the receptacles through a chamber in which a current of air circulates. In processes for the recovery of sulphur from spent oxides, it has also been proposed to remove the spent oxide from the purifiers, and subject it to the action of air in separate receptacles.

According to this invention, the spent oxide is removed from the

purifiers and, if required by its lumpy condition, is broken up by passing it through a screen or subjecting it to some other process of disintegration. The spent oxide is then revivified by "passing through a mass or layer of the oxide such a volume of air as will not only serve to amply revivify the mass of oxide, but will be in such excess as to carry away much of the heat generated by the chemical action and thus reduce the temperature of the oxide during treatment and prevent the oxide from getting so hot as would be the case were the air supply only just sufficient to effect the chemical reaction." This cooling action is assisted by the evaporation of the moisture brought about by the heat of the chemical action and by the evaporative effect of the current of air.

By this treatment, the oxide is amply revivified; but should it become too dry, it may be moistened, either during or after the above-mentioned treatment, by introducing moisture with the air-blast in suitable quantity in the form of live or exhaust steam or by a spray or an atomized jet of water; or, if preferred, it may be moistened after removal from the bin.

A further advantage attaching to this method of treating the spent oxide for revivification is said to be the cleansing of the oxide from a large proportion of the naphthalene which it may have absorbed in the purifier, and which, if allowed to remain, will reduce its efficiency as a purifying agent. This result is obtained by the passing of the large volume of air together with the heat of the chemical action, which together volatilize the naphthalene and dissipate it.

In order to subject the spent oxide to the treatment referred to, it is placed upon a suitably perforated floor, or upon grids or trays B, through which the air is forced by a fan or blower. Where grids or sieves are used, one or more layers may be placed in tiers in a box or chamber through which the air is forced. When the oxide is in such a state as not to require breaking, the spent material may be taken from the purifiers and placed in the chamber for treatment as described, and when the oxide is sufficiently revivified, and in a fit condition, it is returned to position in the purifiers. The chamber in which the treatment takes place is preferably open-topped. B are the grids or trays with oxide B^1 thereon; C indicates the inlet for the air blast; and D, a condensed steam inlet employed for moistening purposes, as described.

Firing Incandescent Gas-Mantles. — Wasmuth, A., of Hamburg. No. 26,909; Dec. 23, 1905.

This invention relates to a machine for firing incandescent gas-mantles—said to be "essentially improved in several respects compared with known machines of the same kind"—in which non-circular discs are employed for operating the gas-cocks and moving the burners; the distinguishing feature being that the incineration of the incandescent bodies is controlled by a mechanical device that can be separately regulated, and the forming and hardening of the incandescent bodies by a second mechanical device which can likewise be separately regulated.

Fixing Igniting Material on Incandescent Mantles.—Hoock, N., and Zucker, L., of Berlin. No. 255; Jan 4, 1906. Date claimed under International Convention, Sept. 19, 1905.

The present invention consists in the use of a mixture of boracic acid, silicic acid, and aluminium hydroxide, together with other subsidiary admixtures, for fixing the igniting pellet to an incandescent mantle. Then, "when the mantle is burnt away, double salts are formed from the basis of the mantle (cerium and thorium compounds) and from the platinum and the fixing material with the siliceous acid, which salts, becoming fused in the lighting substance and the calcined web of the mantle, hold the igniting material firmly in position; moreover, an aluminium boric compound is formed, and the whole produces a porous somewhat flexible fused mass, which impairs neither the lighting of the mantle nor its steadiness." In practice, a mixture of 35 parts by weight of aluminium hydroxide $Al_2(OH)_6$, 5 parts silicic acid, and 59 parts of boracic acid, with the addition of a small quantity of carbonate of lithium or other alkaline metal and of magnesium oxide, has been found to give good results.

Manufacture of Sulphocyanides.—Tcherniac, J., of Streatham Hill, S.W. No. 2708; Feb. 3, 1906.

In patent No. 22,710 of 1902, was described the absorption of cyanogen compounds from coal gas by passing the crude gas (preferably cooled and deprived of tar) through a suitable washer or scrubber containing milk of lime and sulphur. But the patentee has found that if it be desired to produce calcium sulphocyanide, or another sulphocyanide other than ammonium sulphocyanide, the process there described is unsatisfactory, because the ammonia in the crude gas produces a large proportion of ammonium sulphocyanide, the separation of which from the other sulphocyanides is difficult or costly. Moreover, much of the lime is lost as carbonate when the crude gas containing ammonia is passed through the washer.

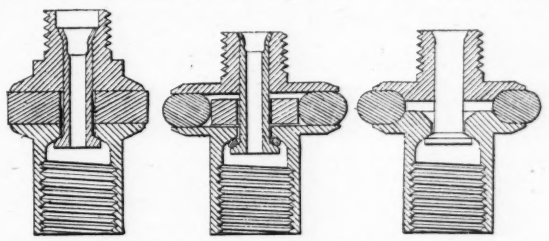
According to his present invention, the crude gas is purified from its ammonia in the usual manner before it is passed through the washer containing the lime and sulphur. It might be supposed, he says, that the lime ought to be present in very large excess in order that the sulphur may be completely converted into sulphocyanide; for in crude coal gas, freed from ammonia, the proportion of hydrocyanic acid to carbon dioxide is about 1 : 8 by volume. He finds, however, that under these conditions the reaction of the hydrocyanic acid of the crude gas with lime and sulphur is, so to say, instantaneous, whereas the absorption of the carbon dioxide by the lime requires a longer time. Thus the excess of lime used need only be about two-thirds more than is represented by the proportion 2S : CaO.

In practice, slaked lime and finely-divided sulphur (the former in the excess named) are introduced, together with the necessary amount of water, into any known form of washer or scrubber, preferably having means for agitating the liquid; and the gas, freed from ammonia but still containing sulphuretted hydrogen, is passed through the mixture "in a systematic manner" until all the free sulphur, or the sulphur dissolved as polysulphide, has entered into combination. This point is, the patentee proceeds, easily detected, inasmuch as when it is attained, the small quantity of iron sulphide which is inevitably present becomes converted into ferrocyanide, so that the greenish black colour of the mixture passes to a greenish yellow. If the right proportion of lime to sulphur has been used, there will now be very little calcium hydrosulphide dissolved in the liquor, which can be easily freed from what there is by further contact with the gas. The mixture may then be directly filtered to yield a solution of practically pure calcium sulphocyanide. Highly concentrated solutions, such as contain 30 per cent. of sulphocyanogen and upwards, may be obtained by this process by using an amount of water for slaking the lime and diluting the mixture in suitable proportion to the quantity of sulphur to be introduced into the washer, by using (instead of pure water) the water with which the mud filtered from the washer liquor has been washed.

Other sulphocyanides can be manufactured by this process in a direct manner by adding to the mixture of lime and sulphur in the above proportions, at the beginning of the operation, a salt capable of double decomposition with the calcium sulphocyanide—for instance, the sulphate or bisulphate of soda. If the latter be used, the quantity of lime must be correspondingly increased. As with the calcium salt, highly concentrated solutions can be obtained, by the same means, and also by using the concentrated solutions of the sulphate for slaking the lime.

Anti-Vibratory Device for Incandescent Gas-Burners.—Van Hoorn, A., and Hemmings, J. F., of Brixton, S.W. No. 8106; April 15, 1905.

This anti-vibratory device for use with incandescent gas-burners is interposed between the gas-fitting and the burner, so as to preserve the mantle from injury. The device comprises essentially two preferably metallic parts adapted to engage one the gas-fitting and the other the burner; each part being formed with a preferably circular flange The flanges oppose each other, and are loosely connected together



by a small tubular spigot formed with a head or enlarged extremity, which takes a bearing in a corresponding seating formed in one of the parts, while the other extremity screws into, or is suitably secured to, the second part. In this manner, the two parts are connected together by what is practically a universal joint, allowing for turning or bending movement in all directions. A ring of india-rubber or other suitable elastic material is arranged between the flanges, thereby forming an elastic seating between the two parts of the device and drawing the spigot up to its seating so as to make a gas-tight joint. Three forms of such joint are illustrated by way of examples.

APPLICATIONS FOR LETTERS PATENT.

7838.—Warry, J., and Arculus, G. N. & E. A., "Inverted incandescent gas-lamp." April 2.
7854.—Terry, G., "Inverted burner fittings." April 2.
7887.—Mason, J. F., and Lines, A. A., "Incandescent burners." April 2.
7897.—Grafton, W., "Argand gas-burners." April 2.
7959.—Carroll, J. B., "Burning acetylene gas." April 2.
7971.—Boswell, C. R., "Gas-engines." April 3.
8048.—Woodall, H. W., and Duckham, A. M'D., "Regulating the flow of gas to atmospheric burners." April 3.
8067.—Aktien-Ges. für Selas-Beleuchtung, "Mixing gas and air for illuminating purposes." April 3.
8119.—Wright, E. T., and Westwood, W. W. S., "Purifiers of coal-gas plant." April 4.
8133.—Staples, J. C., and Green, B. K., "Gas-burners." April 4.
8154.—Terneden, L. J., and Müller, J. M., "Manufacture of water gas." April 4.
8197.—Duncan, R., "Coin-freed meters." April 5.
8203.—Crossley, J., "Anti-vibrator." April 5.
8223.—Terbrack, B., "Gas-stove." April 5.
8241.—Grauwe, F. de, "Gas-stoves." April 5.
8256.—Bloxam, A. G., "Manufacture of water gas." A communication from Watergas Maatschappy System Dr. Kramers and Aarts. April 5.
8276.—Bauke, F., "Suction gas-producers." April 5.
8292.—Gardner, J. A., Manners, F. G., Fairweather, C., and Warnock, T. F., "Manufacture of gas." April 6.
8301.—Bliss, J., "Determining and recording the percentage of carbon dioxide gas in furnace gases or the proportional mixture of any two gases which differ in density." April 6.
8305.—Bartlett, F. G., "Bye-pass gas-tap." April 6.
8362.—Bellowitsch, T., "Manufacture of ferrocyanides from gas-purifying masses or other ferrocyaniferous masses." April 6.
8433.—Jerratsch, T., "Gas-retorts." April 7.

This year the Southport Corporation Gas Department will be in a position to hand over £13,000 in aid of the rates; and a similar amount is promised for next year. The Electricity Department is giving £2750, which is the same as last year.

CORRESPONDENCE.

[We are not responsible for the opinions expressed by Correspondents.]

Purification Results.

SIR,—Mr. Kendrick's communication, appearing in your last issue, refers to us in such a manner that we beg again to ask for a little space in your columns.

We are not conscious of entertaining any "anxiety to agree" with Mr. Kendrick, beyond our uniform desire to disagree with as few people as possible. When, therefore, he expressed the opinion that "the efficiency of a purifier depends upon the velocity of the gas passing through it," we were glad to be able to acquiesce. As to the idea of the vertical extension of purifiers, this is indeed the obvious outcome of the "Jäger" principle.

We are, however, quite content to leave all questions of the merits of these grids to those who have used them. The system is, we believe, the best possible; but, having no desire to obtain free advertisement in your "Correspondence" columns, we propose to take other and more legitimate means of placing the facts and figures before those interested.

Millwall, E., April 12, 1906. SAML. CUTLER AND SONS.

Proposed Associations of Master Gas-Fitters.

Mr. G. H. Tyler, the Secretary of the Birmingham and District Master Gas-Fitters' Association, writes: "It is proposed that, as the formation of this Association has successfully filled a long-felt want, to extend its operations throughout the principal towns in the United Kingdom, and to assist in forming local Associations with headquarters in Birmingham. As it is a difficult matter to commence such negotiations direct, I should be glad if you could see your way to open your columns inviting an expression of opinion as to likely towns. I may mention that the primary object of the Association was, and is, to fight the question of municipal trading; and there are many other matters affecting the trade, such as direct trading, maintenance of prices, &c. You are doubtless aware that the Ironmongers' Association was formed somewhat on the above suggested lines, and now has local branches in practically every large town in the kingdom.

Mid-Oxfordshire Gas Bill.—With reference to the report of the proceedings on this Bill before the Unopposed Bills Committee of the House of Commons which appeared in the "JOURNAL" last week (p. 121), Mr. H. O. Soutter, who was stated to have appeared for the promoters, informs us that he has no connection with the Bill or with the promoters; their Parliamentary Agents being Messrs. Baker and Co., of No. 54, Parliament Street, S.W.

Position of London Water Consumers.

In a leading article headed "The London 'Rake's Progress,'" the "Financial News" recently called attention to the expenditure of the Metropolitan Water Board and the London County Council. Referring to the fact that the Board have had to borrow £120,000 from the Bank of England to carry them over the past financial year, the report for which has not been issued, our contemporary says: "The public have hardly yet realized the altered conditions which affect their relations with the Water Authority of the Metropolis as compared with the days of the Companies. In those days, the Companies were mere sellers of water to the public, with a body of shareholders who provided the capital and took the profits, precisely as the Gas Companies do now. But the public have taken the place of the shareholders, with the certainty that they will get no profits and the probability that the water-rate will have to be raised in order to make good the losses, putting aside the cost of providing a new supply of water, the demand for which is likely to become more insistent as time goes on and the population increases. There is therefore not a very bright look-out for the ratepayers, seeing that the Board has already commenced to borrow money—not for new works, be it observed, but simply for the current expenses of the undertaking." Something akin to this was said over and over again before the Companies were bought out. But the agitators would not rest till the water-works were taken over; and the ratepayers and consumers must abide the consequences."

Proposed Extension of the Gas Supply Area at Leek.—On the 6th inst., a Local Government Board inquiry was held by Mr. F. J. Willis with regard to the issue of a Provisional Order to include within the limits of the supply of gas by the Leek Urban District Council parts of the parishes or townships of Rudyard, Longsdon, Horton, Lowe, and Leekfrith, in the rural district of Leek. The Gas Manager (Mr. A. A. T. Botteley) presented a report; and after hearing technical evidence as to the application, the inquiry was closed. There was no opposition.

Price of Gas at Douglas.—A memorial to the Douglas Town Council has been presented by a number of ratepayers, in which attention is called to the high dividend (14 per cent.) paid by the Gas Company. It is pointed out that no concessions are being made to the consumers, and that no similar company pay such high dividends. When the memorial came before the Council, Alderman Kaye, the Chairman of the Gas Company, stated that the memorialists were under a misapprehension, as, owing to the fact that the majority of shares were issued at a considerable premium, it was not correct to say that 14 per cent. was paid. Gas was as cheap in Douglas as in similar towns in England. The memorial was referred to the Finance Committee.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS.

The following further progress was made with Bills down to the rising of the House last Wednesday for the Easter recess:—

Bill read a second time and committed: Shrewsbury Corporation Water Bill.

Bill reported: Kidderminster Gas Bill [Lords.]

Bills read the third time and passed: Bacup Corporation Bill, Cardiff Gas Bill, Carlisle Corporation Bill, Todmorden Corporation Bill.

The Wallsend Corporation have withdrawn their petition against the Gas Companies (Removal of Sulphur Restrictions) Bill.

The Cheltenham Gas Bill, Derby Gas Bill, Gas Companies (Removal of Sulphur Restrictions) Bill, Southampton Gas Bill, and Tottenham and Edmonton Gas Bill have been referred to a Select Committee, consisting of Mr. Cawley (Chairman), Mr. Cogan, Mr. Rowland Hunt, and Mr. Dudley Ward; to meet on Thursday, April 26.

KIDDERMINSTER GAS BILL.

This Bill came before the Unopposed Bills Committee of the House of Commons—Mr. ALFRED EMMOTT (Chairman of Ways and Means) presiding—on Monday last week.

Mr. L. A. L. NORTH, the Agent for the Bill, stated that one of its principal objects was to convert the stocks of the Kidderminster Gas Company, which at present carry varying interests, into one stock bearing a uniform rate of 5 per cent. The Company was incorporated in 1867, with a capital of £30,000, and it was proposed to take power to raise additional money to the extent of £51,000—the figure of £56,000 originally mentioned in the Bill having been reduced to meet the wishes of the Corporation. The new capital was required to provide for the increased consumption of gas. In 1867 the output was only 54 million cubic feet; at present it was 156 millions. Mr. North explained, in reply to questions by the Committee, that the Company had not been in Parliament since 1867 owing very largely to the fact that negotiations had been entered into at different times by the Corporation with a view to acquiring the undertaking; and the Company felt that they could not apply to Parliament for additional capital when they had the possibility of purchase hanging over their heads. Things, however, had come to such a pass that they could not go on longer without more capital. Hence the present application.

Lord ROBERT CECIL (a member of the Committee) thought it very unusual for a gas company to remain away from Parliament for nearly forty years, and then ask for permission to raise more than double the original capital.

Mr. NORTH agreed that it was unusual, but he said he had given the explanation.

Mr. *W. Newbigging* was then called, and stated that the works of the Company were practically the same to-day as they were in 1867. It would be readily understood that, having regard to the increased consumption, they were now absolutely inadequate to meet the demands of the district supplied. To bring the works up to date, an outlay of £15,000 was necessary; and a new gasholder, which would cost £10,000, was required. The rate of increase in the last ten years had been 33·6 per cent.; and he estimated that during the next fifteen years the growth would be about 78 million cubic feet. He calculated that the cost of production per million cubic feet would be £700; and on this basis they arrived at the capital for which powers were sought. The Company were selling gas at 2s. 6d. per 1000 cubic feet; and though they were a 14-candle Company, they were actually supplying gas of 17-candle power. It was proposed to reduce the maximum price from 4s. 6d. to 3s. 9d.

The CHAIRMAN said he supposed there was not the least intention to raise the capital at once. He assumed it would be obtained as required to meet the gradual increase in consumption.

Witness replied that this was so. He added that the population of Kidderminster was not increasing, but the gas consumption was.

Mr. NORTH stated that the Corporation contemplated extending their boundaries and opening up a new district, which, of course, meant an addition to the number of the Company's customers.

The clauses were then proceeded with. When the testing clause was reached,

Mr. NORTH informed the Committee that the clause originally in the Bill had been struck out on the suggestion of the Lord Chairman of Committees, who wished all the gas companies to come into line with the London testing clause. This had been inserted in the Bill; but he (Mr. North) had quite recently received an intimation from his Lordship that the terms of the clause were not finally settled, and that it would probably have to be amended in the House of Lords.

Sir CHANDOS LEIGH (the Speaker's Counsel) suggested that the clause might stand as it was in the Bill, and that if, as a result of additional information from the Gas Referees, it was further amended, it could, when it came back to the House of Commons in its final form, be passed by the Committee.

The Committee agreed to this course, and the clause was passed. The other clauses were then adjusted; and the Bill was ordered to be reported for third reading.

REPORTS FROM COMMITTEES ON GAS BILLS.

The Committees of the House of Commons who had under consideration the Cardiff, the Thornton District Council, and the Watford Gas Bills made special reports, which have lately been issued.

Taking the three Bills in the order named, the Committee on the Cardiff Bill deal first with the question of the additional capital sought

by the Company, and state that the usual provisions for the offer of it by public auction or tender were varied so as to enable the Company, with the approval of the Board of Trade, to offer any stock or shares created under the powers of the Bill to the consumers and employees, at the average market price in the six months immediately preceding the offer. The Committee point out that a similar variation of the auction clauses is contained in several recent Acts; and accordingly they came to the conclusion that the proposed variation might be sanctioned. The Committee had received a report from the Local Government Board directing their attention to various clauses of the Bill. First as to clause 9, sanctioning the consolidation of shares and stock, it is remarked that if there is an increase in the nominal amount of the existing ordinary capital, there is a corresponding reduction in the amount of the maximum dividends; so that the consumers will not be affected by the proposal. With regard to the suggestion that the Company's existing power to convert into capital moneys borrowed by them under the Act of 1887 should be repealed, the Committee were informed that the whole of such moneys had been raised by the issue of debenture stock, and that it would consequently be impossible for them to be converted into capital. By clause 34, the Company sought for a reduction in the illuminating power of their gas to 14 candles, and the Committee allowed it, "in accordance with the modern practice." With respect to the price of gas, it appeared that, by agreement with the Local Authorities, certain of the Company's maximum prices had been reduced in the Bill as laid before the Committee; but, apart from this, it was pointed out that inasmuch as the Company are now paying their maximum dividend, the consumers would derive the full benefit of the saving which may be effected by reason of the reduction in the illuminating power.

In the report on the Thornton Urban District Gas Bill, the Committee say they gave the recommendations of the Local Government Board due consideration; and in an appendix they set forth the manner in which they were dealt with. A period of thirty years is allowed for the repayment of the money raised to acquire the gas-works of the Poulton-le-Fylde Urban District, and five years more for paying off £15,000 sanctioned for the purchase of land for gas-works purposes. On clause 25, relating to the charges for gas supplied by means of prepayment meters, the Committee allowed 6d. per 1000 cubic feet as the charge for the meter, without fittings.

In the case of the Watford Gas Bill, also the Local Government Board's observations received due consideration. The Committee sanctioned the raising of additional capital and allowed the proposed reduction of illuminating power. With regard to the observations of the Board as to the Company's standard price and dividend, the Committee heard evidence as to the average price charged for gas by the Company during the last few years, and as to the probable effect of the proposals of the Bill on the dividend payable, and decided to reduce the standard price of gas to 4s. 1d. per 1000 cubic feet. As to the observations of the Board on the rate of increase or decrease in the dividend on any variation in the price of gas, it appearing that, so far as the existing capital was concerned, the dividend payable with an increment of 1s. 3d. per half year would be the same as that now received, the Committee saw no reason to depart from the usual practice of allowing the conversion. They also allowed the 1s. 3d. with respect to the additional capital, in accordance with recent precedents.

NOTIFICATION OF ACCIDENTS.

Early in the present session, a Bill was introduced by Mr. Herbert Samuel, on behalf of the Home Office, to amend the law relating to returns and notifications of accidents in mines, quarries, factories, and workshops, under the Notice of Accidents Act, 1894. The purpose of the Bill was to carry out certain recommendations contained in the report of the Departmental Committee appointed in 1901 to inquire into the notification of industrial accidents. Our readers are not specially concerned with the portions of the Bill relating to mines and quarries and the railway sidings in connection therewith, but they are with the remainder, in which an alteration is made in the period of disablement which makes an accident reportable. In the Bill as introduced, clause 4 ran as follows:—

> 1.—Where any accident occurs in a factory or workshop which is (*a*) an accident causing loss of life to a person employed in the factory or workshop, (*b*) an accident due to any machinery moved by mechanical power, or to molten metal, hot liquid, explosion, escape of gas or steam, or to electricity, and so disabling any person employed in the factory or workshop as to cause him to be absent throughout at least one whole day from his ordinary work, (*c*) an accident due to any other special cause which the Secretary of State may specify by order, and causing such disablement as aforesaid, or (*d*) an accident disabling for more than fourteen days a person employed in the factory or workshop from working at his ordinary work, written notice of the accident, in such form, and accompanied by such particulars, as the Secretary of State prescribes, shall forthwith be sent to the inspector of the district, and also in the case of the accidents mentioned in paragraphs (*a*) and (*b*) of this sub-section, and (if the order of the Secretary of State specifying the special cause so requires) of accidents mentioned in paragraph (*c*), to the certifying surgeon of the district.
>
> 2.—If any accident causing disablement is notified under this section, and after notification thereof results in the death of the person disabled, notice in writing of the death shall be sent to the inspector as soon as the death comes to the knowledge of the occupier of the factory or workshop.
>
> 3.—If any notice with respect to an accident in a factory or workshop required to be sent by this section is not sent as so required, the occupier of the factory or workshop shall be liable to a fine not exceeding ten pounds.
>
> 4.—If any accident to which this section applies occurs to a person employed in a factory or workshop the occupier of which is not the actual employer of the person killed or injured, the actual employer shall immediately report the same to the occupier, and in default shall be liable to a fine not exceeding five pounds.
>
> 5.—The foregoing provisions of this section shall be substituted for section 19 of the Factory and Workshop Act, 1901.

When the Bill came before the Standing Committee of the House of Commons on Trade, Mr. H. J. Tennant (a member) moved an amendment to strike out words in sub-section (*b*) which require notice to be given of any accident which so disables any person employed in a factory or workshop as to cause him to be absent throughout at least one whole day from his ordinary work. He said it was conceivable that bad employers might bring their men back for five minutes each day in order to avoid notification. He submitted that time-periods in such legislation were distinctly wrong. It was very important, with a view to preventing accidents, that even comparatively slight accidents should be reported.

Mr. Samuel opposed the amendment, and said that the Government were anxious to maintain the clause as it stood, because it was desirable that all employers should know what their obligations were under the law. It was further desirable that the Trade Unions should know what classes of accidents were intended to be reported. The amendment would require all sorts of trivial accidents to be notified, not only to the inspector of the district, but to the certifying surgeon as well. Mr. Cross thought the amendment would cause an enormous multiplication of reports, which would serve no serious purpose, would convert a useful measure into a piece of official red-tape, and cause friction between employers and employed. Employers had a right to know what their obligations were under an Act like this. The amendment was rejected by a large majority.

Mr. Tennant also proposed that sub-section (*d*) should be amended by substituting seven days for fourteen. Mr. Samuel accepted the amendment for the Government, on the understanding that if a still lower period were fixed in the Workmen's Compensation Bill the sub-section should be brought into conformity with the provisions in that Bill. Mr. Gill thereupon moved to amend the amendment by altering seven days to three. In the course of discussion, Mr. Samuel explained that the accidents contemplated in the Bill might be divided into two classes—those which with care might be prevented, and those which no system of inspection could prevent. In the case of the more serious accidents, the Bill already provided for notice after only one day. The effect of reporting a great number of trivial accidents was to divert the attention of the inspectors from the more serious accidents on which their thought should be concentrated. Mr. Gill's amendment was withdrawn on the understanding that if, when the Bill was brought into harmony with the Workmen's Compensation Bill, the period should not have been reduced to three days, the question would be raised again.

The original amendment was agreed to; and the clause, as amended, as well as the subsequent clauses of the Bill, were passed.

The following new clause—giving power to extend to dangerous occurrences the provisions as to notice of accidents—the terms of which were suggested by Mr. Samuel on behalf of the Government, was moved by Mr. Tennant, and added to the Bill:—

> If the Secretary of State considers that, by reason of the risk of serious injury to persons employed, it is expedient that notice should be given under this Act in every case of any special class of explosion, fire, collapse of buildings, accidents to machinery or plant, or other occurrences in a mine or quarry or in a factory or workshop, the Secretary of State may by order extend the provisions of this Act, requiring notice of accidents to be given to an inspector, to any such class of occurrences, whether personal injury or disablement is caused or not; and where any such order is made, the provisions of this Act shall have effect as extended by the order. The Secretary of State may by any such order allow the required notice of any occurrence to which the order relates, instead of being sent forthwith, to be sent within the time limited by the order.

The Bill, as amended, was then ordered to be reported.

Gas-Stoves for the Battersea Municipal Dwellings.

The Housing Committee of the Battersea Borough Council reported last Tuesday having been for some time in communication with the South Metropolitan Gas Company as to the supply of gas and gas-fittings for cooking purposes only to the tenants on the Town Hall Estate. The Company had stated their willingness to arrange for the supply of gas in bulk to the Council, at the rate of 2s. per 1000 cubic feet, on the following conditions: The gas to be supplied from the rears of the houses; the Company to put in the main and connection to each tenement as far as the meter (including the connection to the meter); the Council to carry out, at their own expense, all cutting away and making good, provide slot meters (by hire or purchase system), and execute all work beyond the meter. The Company will supply slot meters at a rental upon terms to be agreed, and a large meter on hire at the entrance to the estate. The Borough Surveyor had estimated that the cost to the Council of cutting away and making good and excavating for a 3-inch main at the back of the premises, and the provision of 36 stoves, would be £230 10s. 11d. Assuming a loan was obtained for this sum, the repayment being spread over a period of thirty years, that one large meter was hired at the rate of 10s. per annum, and 36 slot meters at 4s. each per annum, it was estimated that the annual cost would be £24 13s. The revenue, on the other hand, supposing the tenants were charged at the rate of 2s. 9d. per 1000 cubic feet, and used 4000 cubic feet of gas per quarter, or 307 cubic feet per week (about 10d. per week), was reckoned at £21 12s. Being convinced of the great convenience which would be afforded to the tenants by the provision of gas-stoves, especially during the summer months, the Committee had decided (subject to the usual sanction) to accept the terms of the Company.

Public Lighting of Wakefield.—There has been recommended by the Street Lighting Committee for adoption by the Wakefield City Council a scheme for improving the lighting of a large number of the public lamps, by the adoption of incandescent burners. There are now 581 flat-flame lamps which it is suggested should be fitted for the incandescent system. A saving in gas of 7s. per lamp (equal to £158 a year) would, it is calculated, be effected; while the cost of conversion is put at £550.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—KING'S BENCH DIVISION.

(*Before Justices* RIDLEY, DARLING, *and* A. T. LAWRENCE.)

Monday, April 9.

The King v. Leach and Others (ex-parte Allen)—Dilemma of the Tenby Corporation.

Mr. MACMORRAN, K.C. (with him Mr. R. CUNNINGHAM GLEN), appeared in this case to show cause against a rule for *certiorari* to bring up to be quashed a resolution of the Tenby Corporation to pay £433 16s. 6d. out of the borough funds, and also to bring up and quash a cheque for this sum which had been drawn by the Corporation in favour of the Treasurer. Counsel said before the year 1900, the Corporation were endeavouring to obtain a better water supply; and acting under the guidance of the Local Government Board, they appointed Engineers to carry out certain investigations at an expense of £433 16s. 6d. These expenses were incurred in December; and as a result of the experiments, the Corporation presented a scheme for the supply of water which was brought before the Board with a view of obtaining a loan of £16,000 to cover the outlay—this sum including the cost of the preliminary investigations. The Board did not approve of the scheme; and the Corporation had to pay the Engineers for their investigation work. They applied to their Treasurer, and asked him to pay the amounts; and this he consented to do on condition that they were provided for in the next rate. The money was paid; but before the next rate was made the Corporation came to the conclusion that, as they would have to go to the Board again, the sum should be included in the cost of that application. The Treasurer did not agree to this course; and they therefore appointed a new Treasurer, who paid the amount to his predecessor. Mr. Allen then applied to the Divisional Court, and had the order quashed, with the result that the Corporation became indebted to the Treasurer in the sum of £693 9s. 3d. There now being a surplus of borough funds in hand, they had drawn a cheque, payable to the Treasurer, for the amount due to the Engineers, and *certiorari* was moved for, and a rule *nisi* granted, to bring up the cheque for the purpose of its being quashed, on the ground that the payment was beyond the powers of the Corporation, was illegal, and was a breach of trust. The Corporation were still in difficulties about a water supply; but when they had a scheme which had been sanctioned by the Local Government Board, they considered that they would be entitled to include in the loan the cost incurred in looking for a supply.

Justice DARLING asked why the Corporation had not applied to the Board to sanction the payment.

Mr. MACMORRAN said the matter would come before the Board when they were asked to sanction a proper water scheme. The question now was whether the Corporation could apply their surplus funds towards the payment of the debt; and this depended upon the construction of the Municipal Corporations Act, 1882, which provided that payments for the "public benefit of the inhabitants or the improvement of the borough" might be paid.

Justice DARLING thought it might be said that it was not for the benefit of the inhabitants that the debt should be paid. As the work had been done, it would be for their benefit that the Engineers should not be paid.

Mr. MACMORRAN said the law recognized the principle that persons who incurred debts should pay them. He submitted that the payment was one which could be properly made under section 143 of the Act, being for the "public benefit of the inhabitants;" and in support of this contention he cited the case of *Regina v. Mayor of Liverpool*.

Justice DARLING: If we decide that this sum cannot be paid out of the borough funds, from what fund can it be paid?

Mr. MACMORRAN said it could not be paid at all. The Corporation could not make a rate in respect of it as the debt was not incurred for a strictly statutory purpose.

Justice DARLING asked Counsel for the respondents if he knew any way in which the amount could be paid.

Mr. PALMER, who appeared with Mr. DANCKWERTS, K.C., said it could only be done by obtaining an Act of Parliament or a Provisional Order, or by sanction of the Local Government Board.

Mr. MACMORRAN said there was no doubt the Treasurer could recover judgment and levy execution upon the property of the Corporation, which was not a very desirable thing to contemplate.

Mr. PALMER at some length supported the rule; arguing that it was improper to employ Corporation funds in paying that which was not a debt. He admitted that they had a perfect right to incur the debt to the Engineers in the first instance; but by carrying the amount to a suspense account, and the new Treasurer paying it to the old one for what was an illegal debt, he could not now recover the amount.

Justice RIDLEY said he was clearly of opinion that the rule ought to be discharged. He hoped this would be the last time the Court would hear anything about this very proper expenditure, as he thought it was at the outset. With the view of supplying the borough with water, the Corporation employed Engineers to do certain work; but as the scheme did not receive the sanction of the Local Government Board, it was now alleged that the money was thrown away, and that the efforts of the experts were abortive. This was a mistake. He did not think such a phrase could properly be used in respect of the expenditure, which was incurred with the view of benefiting the borough. After this had been done, the Corporation made the mistake of endeavouring to satisfy the payment to the Engineers out of the general district rate. They went through various operations of borrowing, the effect of which was, according to the judgment of that Court in May, 1904, that they were endeavouring to go beyond the powers given them under the Public Health Act, as they were borrowing without the consent of the Local Government Board. After this, the Corporation took steps to satisfy the debt; and there being a surplus in the borough fund, they proposed to pay the money out of it. One might stop and ask what would have been the case if there had been no such surplus. The alternative would have been to wait until the subsequent scheme, which must some day be brought up, came before the Local Government Board for approval, and then to include the expense already incurred. Fortunately, there was a surplus; and the question was whether it could within the meaning of section 143 of the Municipal Corporations Act, be applied, to these purposes. This section provided that the surplus should be applied, under the direction of the Council, for the "public benefit of the inhabitants or the improvement of the borough." He was clearly of opinion that the surplus could be applied for this purpose, and that it came within the principle of the decision in the case cited, where the question was the cost of tramways which had been acquired by the Corporation. If one had to go into the merits of the case, he should say that the supply of pure water was more for the public benefit of the inhabitants than the laying down of tram lines.

Justices DARLING and LAWRENCE gave judgment to the like effect. The rule was accordingly discharged, with costs.

Liability for Supplying Impure Water.

An important decision has lately been given by His Honour Judge Gye, in the Basingstoke County Court, in an action brought by the Basingstoke Corporation against Mr. Herbert Andrews, a local butcher, to recover the sum of 9s. 4d. for water supplied in the quarter ending the 29th of September last. The defendant declined to pay the amount claimed, on the ground that the water supply was contaminated, and that his nephew had in consequence suffered from an attack of typhoid fever, of which there was an epidemic in the town last autumn. The Corporation declined to admit that the water was impure; but his Honour, after hearing the evidence of the Medical Officer of Health, who positively asserted that the water was contaminated by sewage, rejected the evidence of the Borough Surveyor, who contended that this had never been proved. The Judge came to the conclusion that the water was undoubtedly contaminated, and that typhoid fever was the result. As the Corporation were bound by Act of Parliament to supply pure water, they could not claim payment of their demand. It was also submitted that the defendant, having taken the water and used it, was bound to pay for it; and that if it was not pure and wholesome another remedy was provided. It is stated that a large number of actions have been entered in the High Court of Justice against the Corporation in connection with the epidemic.

Special Water-Rate Dispute at Bargoed.

At the Caerphilly Police Court, last Tuesday, judgment was given in a case which was before the Magistrates on the 6th ult. It was a summons taken out by Mr. J. Jenkins, the owner and occupier of No. 2, Upper High Street, Bargoed, against the Rhymney and Aber Valleys Gas and Water Company for "refusing to furnish him with a supply of water during part of the time for which the rates for the supply had been tendered;" and the action was brought as a test case. Mr. T. J. Thomas, who appeared for the complainant, said the proceedings were taken out under section 43 of the Water-Works Clauses Act, 1847. The Company had refused to supply the prosecutor with water when called upon to do so, and were consequently liable to a penalty of £10 and a further sum of 40s. per day. The water was cut off on the 12th of January. He referred to the Company's Act, which stated that they were not bound to supply water except by meter to any place of business; but he contended that the "premises" in question was only an ordinary cottage converted into a shop, and that no more water was used in them than in a dwelling-house. Plaintiff was called, and stated that he sold fruit, sweets, &c., on the premises in question, which had been converted from a cottage into a small shop. The house was rated at £8, and as a shop at £17. On the 11th of January he met Mr. Knight, the Bargoed Manager of the Company, and was asked if he was going to pay the special water rate for the premises. He replied in the negative, but said he was willing to pay the usual rate. This was 8s. 6d., and the extra rate 2s. 2d. The next day a man called at the house and cut off the supply. On the 18th of January, he, in company with Mr. Felix Davies, attended at the Company's office at Caerphilly, where he saw the Engineer and Manager (Mr. A. R. Cawley). Witness said he came to tender him the 8s. 6d. for the ordinary water-rate; but he declined to accept the money. Witness did not use any more water now that the premises were a shop than he did when the place was a cottage. He washed the shop out once a week. In answer to Mr. Meredith, who appeared for the Company, witness admitted that he sold all kinds of greengrocery, but said he did not wash anything. He was not aware that the Company were entitled to make an extra charge of one-fourth the usual rate. Mr. Meredith remarked that, as the plaintiff was a confectioner, the Company could demand half the usual rate; so that they had let him down very lightly. He went on to say that the Company were not obliged to present demands. It was the duty of the consumer to pay the charges made; and the supply had been cut off because Mr. Jenkins had declined to pay the special water-rate. The premises were dwelling-house and shop, and they were used for trade purposes; and it was immaterial, so far as the Company were concerned, how much water was taken. For business premises they were entitled to demand a special rate; and this right was provided for in their Act. Mr. Cawley was called, and said the Company were under no obligation to give 12 hours' notice in writing that the supply of water would be cut off. The case was adjourned to allow the Magistrates to consider it. They came to the conclusion that they must give a verdict for the defendants, though they thought the Company had dealt very harshly with the plaintiff. The case would therefore be dismissed, but without costs.

The Keighley Gas Committee estimate that they will this year, as last, be in a position to hand over from profits £3000 in relief of the rates, in addition to bearing the cost of public lighting—about £3000—and of the Fire Brigade.

MISCELLANEOUS NEWS.

THE CHELTENHAM GAS BILL.

Provisional Withdrawal of Opposition in the Commons to the Sulphur and other Clauses.

Following up the reference in our "Notes from Westminster" last week to the agreement arrived at between the Cheltenham Corporation and the Gas Company with regard to the Bill which is being promoted by the latter in the present session of Parliament, we append a lengthy statement on the subject published in the "Cheltenham Examiner," a copy of which has been forwarded to us by Mr. R. O. Paterson, the Company's Engineer and Manager.

The fact that the representatives of the Corporation and the Gas Company have arrived at a basis of agreement having been made public, we are free to state in some detail the terms upon which it is proposed to withdraw opposition to the Company's Bill in the Commons. The proposed withdrawal is limited to the Lower House. In a certain eventuality, the Corporation will be at liberty to revive their opposition in the Lords; but in the event of their deciding so to do, the terms now agreed upon will be of non-effect. The Company, on the one hand, will be entitled to disregard the negotiations which have taken place, and which may not be quoted against them; and the Corporation, on the other hand, will be able to revive their opposition untrammelled by the conditions they have provisionally accepted. Both parties will stand as though no negotiations had taken place.

The point on which the option of opposition in the Lords may arise is that of the purification of gas from sulphur. The treatment of gas with lime in the process of this purification has hitherto been insisted on; and when the Company last went to Parliament, ten years ago, the lessening of sulphur impurity was considered so far of moment that the Corporation succeeded in imposing on the former a substantial reduction (from 30 grains to 25 grains) upon the maximum impurity allowed. Now the Company propose by their Bill to abolish altogether the test for sulphur. They are not isolated in this action. Several companies are seeking to do away with the obligation to purify from sulphur. About a score of these are combining in one application, and will be resisted, unless the opponents are in the meantime advised to the contrary, by an equal combination of corporations. Advantage is taken of this fact in the arrangement now proposed between the Cheltenham Company and the Corporation. It is arranged between them that the Corporation shall withdraw their opposition to the Local Bill in the Commons, on the undertaking by the Company to insert certain agreed clauses in the measure when it comes before the Lords, if no opposition is then offered to its passing. No such opposition will be offered, if, in the meantime, the Associated Companies' Bill has passed through the Commons. If, on the other hand, the corporations have defeated the companies, and the abandonment of the sulphur test has been refused, it will be open to the Corporation to reconsider their position. In the event of the Company refusing to give, and the Corporation deciding to demand, the restoration of the sulphur test, then the former will be at liberty, as we have said, to disregard the results of the present negotiations, and freedom of action will be restored to both sides.

Among other proposals of the Bill as it stands are an extension of the Company's area of supply, a reduction of the minimum illuminating power of the gas, arrangements for the substitution of incandescent burners for the present fittings, and variations of existing requirements for testing pressure, &c. To the extension of area no objection has been raised. The reduction of illuminating power is a point upon which the result of opposition would be doubtful, and which has, at least, something to be said in its favour. The reduction proposed is nominally from a minimum of 15 candles, as fixed by the Act of 1896, to one of 14 candles; but as the test of illumination is in the future to be by what is known as the "Argand burner No. 2" (now usually adopted), instead of by "Burner No. 1," the reduction will, in fact, be considerably more than 1 candle. Probably 12⅔ candles would be the illuminating power of the gas. Though this may seem a large reduction from the present standard, it must be remembered that quality, both in illuminating power and purity, is much less important than formerly. Gas is now used chiefly for heating purposes —the illumination of the incandescent light being derived from the heating of the mantle; and for such uses an inferior product is almost equally efficient. It is this consideration, probably, which has led Parliament to allow a reduction in the standard, similar to that now asked for by the Company, in recent Acts. Lower illuminating power stands for cheaper coal, just as the abolition of the sulphur test means lower cost of production. In view of the result of other applications to Parliament, it has not been thought wise to oppose the Company on this point, if opposition on other points could be avoided. On questions of pressure and testing, the Company have practically conceded the demands of the Corporation. Tests are to be taken at any time between 9 a.m. and 11 p.m., and pressure may be gauged at the heads of the street-lamps instead of at the "junction of the service-pipes with the mains"—a provision which, as it involved the breaking up of the roads, was simply useless.

The point on which the strongest contention has arisen is outside the scope of the Bill as presented by the Company. It has reference to a provision in section 51 of the Cheltenham Improvement Act, 1852, under which the Company are given special powers to drain their refuse into the public sewers. It has been stated that these were given to buy off the opposition of the Company to the passing of the Act. Whether this be so or not, the exercise of the powers has on more than one occasion been a subject of complaint. Only in August last the stoppage of the old sewer connected with the Company's works necessitated the construction of a new sewer at the cost of the town; and the fact that this new sewer is already blocked by refuse, led the Corporation to resolve that the application of the Company to Parliament should be used as an opportunity for limiting the powers which the Act of 1852 conferred. This difficulty has now been arranged satisfactorily. The clause to which the Company have agreed provides that, the section of the Improvement Act notwithstanding, the Company shall use the "best known practical means" of rendering innocuous any refuse turned into the sewers, and gives a right of entry to the works to ascertain that such means are being used. It is right to say that negotiations over this difficulty were furthered by the desire of the Directors to meet the reasonable requirements of the town without unduly foregoing the Company's rights under the Act of 1852.

The Town Council also sought to impose upon the Company a clause providing that the opening of the foot and roadways for gas mains and pipes should be made by, and under the direction of, the officers of the Corporation. A working arrangement with this object has been for some time in existence between the two bodies; but a strong objection was raised to giving it the force of an Act of Parliament. Ultimately a compromise was arrived at; the clause being withdrawn upon the Company entering into an agreement to continue the present arrangement for ten years, with an option of determining it only on the part of the Corporation.

The conference at which the heads of agreement were arranged was held at the offices of the Company's Parliamentary Agents, Messrs. Dyson and Co. The Town Council were represented by Alderman Norman (Chairman of the General Purposes Committee), Councillor Ley Wood (Chairman of the Lighting Committee), and Councillor R. E. Marshall, with Mr. Ringrose (Messrs. Ellis and Ellis, Parliamentary Agents), Mr. R. O. Seacome (Town Clerk), Mr. E. H. Stevenson (expert adviser), and Mr. H. Matthews (Gas Inspector). Mr. Rowland Ticehurst (Chairman), and Alderman Winterbotham and Mr. Witts (Directors) represented the Gas Company, with Sir George Livesey (their adviser), Mr. R. O. Paterson (Gas Manager), Mr. C. E. C. Browne (Messrs. Dyson and Co.), and Mr. Wyatt (Secretary and Solicitor). The conference occupied four or five hours; and a rupture of negotiations was on several points narrowly avoided. But with a desire on both sides to save the expense and irritation of parliamentary opposition, the compromise was ultimately arrived at.

At a meeting of the General Purposes Committee last Tuesday the action of the Council representatives was approved. A special meeting of the Council will be held this week for its final confirmation. The Company's deputation had plenary powers at the conference.

THE DEVONPORT GAS EXPLOSION.

Discussion in the Town Council.

A report on the recent serious gas explosion at the shop of Mr. J. B. Love, draper,* was presented to the Devonport Town Council on Thursday last. The report stated that the Gas Engineer (Mr. J. W Buckley) explained to the Gas Committee that the cause of the explosion was that the man who was laying a service-pipe to Mr. Love's shop negligently omitted to plug the pipe before connecting it with the street main. The Town Clerk advised the Committee that, after going carefully into all the circumstances of the case, he was of opinion the Corporation were liable. With reference to the damage sustained, Mr. Love claimed £350 for loss of trade and damage to business and other expenses not covered by insurance. The North British Insurance Company stated that their assessors had agreed with Mr. Love's valuer that the damage to buildings was £566 17s. 3d., and to stock £1509 1s. 1d., the total claim (including £60 16s. 9d. assessors' fee), therefore, being £2126 15s. 1d. The Chairman and the Town Clerk reported that two assistants who were injured had agreed to accept £35 each, which sums had been paid them, in full settlement of all claims against the Corporation. The Committee resolved that £2476 15s. 1d. be handed to Mr. Love in full discharge of all his claims, and that this sum be paid out of the reserve fund of the gas undertaking. Claims by the Salvation Army and another person for compensation for damage to their premises, were referred to the Engineer, with power to act. At a subsequent meeting, it was reported that the claim of Mr. Love had been paid; and that a claim of £10 for injury to a girl who was hurt had been withdrawn, and the sum of £30 demanded. It was agreed that £15 should be paid in satisfaction of this claim, and £6 to make good the damage to the premises of the Salvation Army. A further claim of £37 6s. 6d. on behalf of assistants to Mr. Love whose clothing was damaged, was referred to a Sub-Committee, with power to act. The Works Sub-Committee reported that after most searching investigation and inquiry, they found that the cause of the explosion was the neglect of the service layer (since dismissed) in omitting to plug the 1¼-inch service-pipe previous to connecting it to the main. They were also of opinion that the Outdoor Superintendent could not be exonerated from blame for not exercising the supervision which such work necessitates. The Engineer was requested to report from time to time during the next three months upon the administration of the outdoor department; and instructions had been given for every possible precaution to be taken to avert a similar occurrence.

Alderman HORNBROOK, the Chairman of the Committee, in moving that these minutes be confirmed, remarked that it was difficult to say anything with regard to such a calamity. It was, nevertheless, strange that three such accidents had occurred at different places within the last few weeks. Here they had a man so careless as to put in a pipe, let it go into a house, and connect it with the main without putting on a cap. What could be said of such conduct? One of the places which had suffered from a similar experience was less fortunate than Devonport, because they had no surplus with which to pay for the damage, and it had had to be borne out of the rates. In Devonport, they had a reserve fund; and the cost would not have to come out of the pockets of the ratepayers. This did not, however, lessen the calamity, or the anxiety which it had caused the Committee or the officials. Before this occurrence, they were going on splendidly in the Gas Committee. They were pursuing a policy of retrenchment; and they expected to have a good report to present the Council on the result

*See "JOURNAL," Vol. XCIII., pp. 745, 819.

of the year's working. The man directly responsible for the accident had been discharged, because they felt it was impossible to trust him again. As to the settlement, the Town Clerk and the Gas Committee had tried to do the thing which was right and just. The expense was heavy; but it had all been met. Mr. Love had not claimed a farthing for personal injury, though the circumstances were such as would have led many men to put in a very heavy claim on that account.

Mr. RENDLE, while believing that Mr. Love was entitled to all the compensation he had received, thought the Gas Committee had acted in a very unbusinesslike way. They were told that Mr. Love's valuer had agreed with the assessor of the Assurance Company. Why was there no valuer on behalf of the Corporation?

Mr. PAUL protested against the suggestion that the Gas Committee, with the assistance of the Town Clerk, were not capable of making a businesslike arrangement. If they did not have a valuer of their own, they had the advice of the Town Clerk, who personally saw the valuers. In his opinion, the Chairman of the Committee and the Town Clerk were to be congratulated on getting the matter settled so quickly and satisfactorily.

Mr. PRIOR said the employment of another valuer would only have added to the cost; and he doubted whether the Corporation would have got off any cheaper. Having regard to what he saw of the premises after the explosion, he did not think the Corporation were paying too much. He could not, however, agree with the Chairman of the Gas Committee that the loss did not affect the ratepayers. If the Committee were making such big profits that they could afford to treat a claim of this kind with something like indifference, he hoped they would have a contribution from them towards the reduction of the rates.

Mr. GOODMAN was sorry that so light a view should have been taken of so serious a matter. What he would have liked was that the Local Government Board should have been asked to send down an inspector to inquire into the whole matter. He should be glad to know what arrangements were made between the Gas Committee and Mr. Love with regard to the installation of high-pressure gas lighting on his premises, and why, if it was desired to test that system of lighting, it was not tried elsewhere. He also thought the Council should have been represented by a valuer in the assessment of the damage. He would remind the Gas Committee that they did not own the gas-works, and they had no right to ignore the Council. The explosion was the Nemesis which had followed upon the policy of the Committee. What howls of execration would have gone up if it had happened six or eight months ago. As it was, there was an indecent haste to hush up the whole thing and settle the claims before the Council were consulted. If there had been an inquiry by a Local Government Board inspector, it might have revealed something which would prevent anything of the kind ever happening again.

Alderman HORNBROOK replied that it was ridiculous to talk of revelations. Mr. Goodman had used language of the same kind before, and when challenged had run away. No one in Devonport believed there was anything in Mr. Goodman's insinuations; and Mr. Goodman did not believe them himself. The Committee, on the best advice, settled things up as rapidly as possible. They were not quick enough in the settlement of one or two claims, and they had to pay for the delay. In the case of two lady assistants who sustained injury, the claim was for £25 each; but the Committee decided to give them £35 each, and they were still underpaid for the suffering they experienced. Another claim which was sent in for £10 was not immediately met, and was increased to £30. [Mr. GOODMAN: And quite right, too.] That remark was an example of the spirit of animus towards the Committee of which he complained. It did not seem right that a member of the Council should have being going about after the accident saying that he hoped the Council would be severely punished.

The minutes of the Committee were then approved.

STOPCOCKS ON SERVICE-PIPES IN EDINBURGH.

Relics of the Early Days of Gas Supply.

Chance put into the hands of our Scotch Correspondent a few days ago a copy of the "Edinburgh Evening Courant" for Monday, Nov. 29, 1824. This was only a few years after the introduction of gas into the city—the Edinburgh Gaslight Company having been formed in 1817; and consequently he looked to see if any reference was made to it. He found there was. The newspaper contained, to the extent of nearly half of its space, an account, with illustrations (wood engravings), of a series of great fires in the High Street, in which much valuable property, including the office of the "Courant" itself, the Parliament House, &c., was destroyed. Then, in the column devoted to local paragraphs there was the announcement: "Edinburgh Gaslight Company.—A correspondent informs us that all the service-pipes laid by this Company for the supply of coal gas to the public are provided with stopcocks in the pavement, at several feet distance from the houses, by which means the gas is at once shut off from them separately; and that at the late fires it was entirely shut off, not only from the houses burning, but from those round about, within a very few minutes after the alarm was given." It appears that the same arrangement prevails at the present day. It is interesting to learn that the practice of fixing stopcocks upon service-pipes was in existence at so early a period.

Ratepayers and Gas Profits.—Councillor Skinner, of Halifax, in the course of a speech at a ward meeting, remarked that he was opposed to using the profits of the gas-works for the relief of rates, when gentlemen, who did not help to make the profits, were thereby relieved of serious burdens. People who did not contribute to the profits ought not to participate in the distribution of those funds. He believed in direct taxation. The moment a man recognized that he had to pay more n rates, he would begin to think. The Gas Committee had been compelled, under a threat, to reduce the price of gas for power purposes The yearly consumption for power in Halifax was 70 million cubic feet; and that for lighting and heating was 770 millions.

RIVER PLATE GAS COMPANY, LIMITED.

Prosperity Amid Labour Troubles.

The Annual General Meeting of this Company was held last Thursday, at River Plate House, Finsbury Circus, E.C.—Mr. A. E. BOWEN in the chair.

The SECRETARY (Mr. Henry T. Adkins) read the notice calling the meeting; and the Directors' report and the statement of accounts were taken as read.

The CHAIRMAN, in moving the adoption of the report and accounts, said, before proceeding with the general business, he wished to refer to the great loss the Company had sustained in the death of their good friend Don Meliton Panelo, which occurred in Buenos Ayres in May last. The event came upon the Board as a "bolt from the blue." His death was quite unexpected; he having been ill for two days only. Don Meliton was for many years President of the old Argentine Gas Company; and when the present Company was formed, on the basis of the amalgamation of the Argentine and Belgrano Companies, he became President of the Local Committee in Buenos Ayres. In that capacity he had done magnificent work. For eight years he was the life and soul of the organization in Buenos Ayres; and his influence with the authorities and the Company's customers was invaluable. Fortunately they had another first-rate man to fall back upon; and the Directors induced Mr. F. W. Woodgate to accept the post of President of the Local Board. Mr. Woodgate was General Manager of the old Argentine Gas Company for many years; and he joined the Local Board when this Company was established. His life-long experience of the gas business in Buenos Ayres served them in good stead; the business being carried on as smoothly and successfully as ever, as would be realized from the figures before them that day. Having mentioned that one of his colleagues (Mr. Hooper) was still ill, he said that another fellow-Director—Mr. Ogilvie—was in Buenos Ayres, where he had been giving a great deal of time and attention to the affairs of the Company. His presence there just now had been of immense advantage to the Company, as they had been able to avail themselves of his services in connection with the rather delicate negotiations the Company had pending with the Municipality. The Board had also lost Mr. H. G. Anderson; he having decided that the time had come when he was entitled to relief from all City cares and responsibilities. He (the Chairman) was very pleased to be able once again to meet the shareholders with a record report. For the preceding year (their best up to then) the profits were £114,747; whereas this year they had £120,934 to deal with. The shareholders would no doubt consider this a very satisfactory increase. The great prosperity of the Argentine continued; and the City of Buenos Ayres was still expanding rapidly, particularly in the direction where the Company laid the new mains about which he had spoken at previous meetings. Last year the Directors had to report the acquisition of 1957 new customers on balance; but this year they were able to count upon 2181 more. They had also added another 10 miles to their network of mains; making altogether 419 miles. They also now lighted 7630 public lamps—an increase of 64 lamps over last year. During two or three years the sale of gas fell off; and this the Board attributed to the use of the incandescent burner. In the past year, the sales increased by 5·80 per cent.; and this on top of an increase of 6¾ per cent. in 1904. This increase had been fully maintained during the first two months of 1906—indeed, the private lighting increase for January was no less than 13·38 per cent., which was a record for the Company. The business in cookers, heating-stoves, and incandescent burners continued to increase very rapidly—in fact, it had taken them all their time to keep pace with the sales of cookers; and they were continually increasing their shipments. The Company's customers, too, continued to favour incandescent burners, and were changing to them more rapidly than ever before. The Electricity Company were also doing very well in Buenos Ayres. It must, however, be remembered that it was a very big city, with more than a million inhabitants. The Company did not suffer from this competition; so that there was evidently plenty of room for both classes of lighting. The Company's relations with the Municipality and other authorities continued to be very cordial. Nothing more had been done about the different projects of which he had spoken at the last two or three meetings. The sudden death of Dr. Quintana, the President of the Republic, which took place about a month ago, had brought about a change in the Municipal Authorities. Dr. Rosetti had resigned the office of Lord Mayor; and Don Alberto Casaros, who had been Intendente before, had been appointed in his place. It might well be that this gentleman would push forward projects which were allowed to sleep by his predecessor. However, they had no reason whatever to think that Don Casaros would not treat the Gas Companies with the same justice and consideration that they had received up to the present. During the year, the labour troubles in Buenos Ayres had been worse than ever; and every industry had suffered more or less from strikes. He was glad to say, however, that the Company had not been compelled to shut down for a single day, and that, on the whole, their men had behaved very well indeed. He mentioned last year that the increase in wages would cost the Company about £7000 a year. As a matter of fact, this amount was under the mark, as, owing to the shorter hours the men now worked, the Directors needed an increased staff, which received much higher wages per day for shorter hours. It was, under these circumstances, all the more satisfactory that the profit for the year showed so well. The shareholders would see by the report that during the year the Directors had spent £19,665 on the upkeep of the works and mains, against £16,009 in 1904. Of course, everything was maintained in the most efficient order, and up to the high standard fixed by their Chief Engineer, Mr. Rowbotham. They could not, in fact, do any more in this way at present. The new issue of capital was a success. Some 924 shares were not taken up, and were sold by their brokers at a profit of £1570, which was passed direct to the reserve fund. Those shareholders who had several times asked how the reserve fund was invested, would now have the satisfaction of knowing that it was out of the business, and snugly tucked away in gilt-edged securities, realizable at any moment. Turning to the accounts, the revenue account showed a profit of £116,295, against £113,237 in 1904, or an increase

of £3058. The debenture interest was the same as last year. The general expenses (London and Buenos Ayres) exhibited an increase of £1000, which was made up of increased income-tax, and a year's salary paid to their ex-Secretary (Mr. Heald) when he left the Company's service. The Directors hoped that in the current year there would be some reduction in these charges, and it might be also that they would get some relief from reduced income-tax. As to the balance-sheet, the capital was increased by £148,930, owing to the new issue. The debenture stock remained the same as last year. Sundry creditors and credit balances were reduced from £35,506 to £30,235. The reserve fund was £121,570, against £95,000 last year; and if the shareholders approved the Directors' proposals, it would stand at the nice figure of £145,000. The capital expenditure for the year was £17,213, which was more or less the same as they spent the year before. The principal items of this expenditure were: Ten miles of new mains, about £6000; new house services and meters, £8000; further purchase of land at Corralos, £2500; and the remainder was made up by several items of plant. Stock of coals, gas, &c., now stood at £78,873, against £81,976 last year. Sundry debtors and debit balances were £34,070, against £44,471, which was a very satisfactory reduction, as it proved that their collections were well up to date. The accounts were rendered monthly; and this really meant that not much more than the December accounts were pending. In this connection, he was glad to say that the Municipality had paid up splendidly; and even the December accounts for street lighting were paid in the middle of January. He now came to a new item in the balance-sheet, which was that of investments in London, amounting to £121,968. These investments were all first class—Consols, trustee stocks, and railway debentures; and they were taken into the accounts at the medium prices of Dec. 31 last. If the shareholders sanctioned the proposed increase in the reserve fund, the investments would be correspondingly augmented. The cash and bills amounted to £100,000, against £49,898 last time; so the shareholders would see that, even after investing the reserve fund, they had ample means for carrying on the business. Regarding the appropriation of the balance at the credit of profit and loss account, the Directors proposed to add to the reserve £23,429, making, with the small profit received on the sale of the new shares (£1570), a total of £145,000. They had thought it advisable to commence an old age and pension fund, and hoped to add to this yearly, until it became a respectable sum. The Board thought it would be an inducement to their people in Buenos Ayres to remain in the service of the Company. The Directors proposed to pay the same dividend of 8s. per share, free of income-tax, making 7 per cent. for the year, and to carry forward £21,222—just about the same as the amount brought in.

Mr. C. J. HEGAN seconded the motion.

Mr. SKEEL remarked that from 1898 to 1906, the Directors had done very well for the shareholders, who had been receiving a dividend of 7 per cent. They had heard at this and other meetings that things were in a bright position at Buenos Ayres; but the shareholders were not participating in the increased prosperity. It seemed to him that £25,000 was a large amount out of about £95,000 to carry to reserve. When things were bad, the Directors would perhaps tell them that the shareholders' dividends should go down; but when things were good, they were not standing in with others with the prosperity.

The CHAIRMAN replied that what Mr. Skeel said was perfectly true. The fact of the matter was they had the new capital to think about; and this would require a considerable amount more dividend. Then there was the eternal question with the Municipality. The shareholders would see it would never do to increase the dividend until the Directors came to some arrangement with the Authority. But once the municipal question was settled, and they saw how far labour troubles were going to affect the earnings, they might then do something more. He had had some idea that a little more could be given to the shareholders on this occasion; but their representatives in Buenos Ayres strongly recommended that it would not be in the interests of the Company.

The motion was unanimously carried.

The CHAIRMAN then proposed, and Mr. A. LE ROSSIGNOL seconded, the declaration of a final dividend for the year at the rate of 8s. per share, making 7 per cent. for the year, free of income-tax.

On the proposition of Mr. C. J. HEGAN, seconded by Mr. A. LE ROSSIGNOL, the Chairman (who retired by rotation) was unanimously re-elected; Mr. Hegan remarking that he did not hesitate to say the success of the Company was chiefly due to Mr. Bowen's energy, business ability, and knowledge of the Argentine.

Moved by the CHAIRMAN, and seconded by Mr. HEGAN, Mr. C. P. Ogilvie was also returned to his seat at the Board.

The Auditors (Messrs. Welton, Jones, and Co.) were likewise reappointed.

The CHAIRMAN invited the shareholders to join the Board in a hearty vote of thanks to the Secretary and the London staff, to the Chairman of the Local Committee, and to the chief officers and staff in Buenos Ayres. Owing to the late strikes and labour troubles, their officers there had had a very anxious year. Although their men continued to work, agitators were continually "at them," trying to talk them into striking; and it was only the very delicate handling they received from the General Manager and Chief Engineer which kept them in their places. Then the strikes at the docks and among other labourers caused a considerable amount of loss, owing to the difficulties experienced in discharging coals and other materials, and getting them to the different works.

Mr. PLOWMAN seconded the motion, which was heartily endorsed by the meeting.

Proposed by Mr. H. G. ANDERSON, and seconded by Mr. F. J. YARROW, a cordial vote of thanks was also passed to the Chairman and Directors.

A brief reply by the CHAIRMAN and the SECRETARY concluded the proceedings.

The Langley Mill and Heanor Gas Company have placed an order with Messrs. Robert Dempster and Sons, Limited, of Elland, for a steel tank 101 ft. 9 in. diameter and 20 ft. 6 in. deep, and a telescopic gasholder on the spiral-guided system.

GAS AND WATER SUPPLY IN WALES.

Progress of the Rhymney and Aber Valleys Gas and Water Company.

At the Meeting, of the above-named Company on the 6th inst., the Directors presented their eighth annual report and accounts, covering the twelve months ending the 31st of December last. They showed that the expenditure on capital account in the year was £29,608, bringing up the total to £191,270. The bulk of the outlay was in respect of the water portion of the undertaking; no less than £19,524 having been spent upon mains. Of these, there was now 9½ miles in use, as well as 4 miles of gas-mains; 3404 yards of the former and 592 yards of the latter having been laid in the year. The number of water consumers rose in the twelve months from 6070 to 7142, or 17·66 per cent.; and there was an increase in the area of the Rhymney Urban District Council, which is supplied in bulk by meter. An increase to the extent of 1·81 per cent. was reported in the quantity of gas sold, and in the number of consumers of 5 per cent., compared with 1904. The revenue account shows a profit for the year of £4619, which, added to the balance brought forward, makes a total of £8056. The amount available for dividend was £3818; but the Directors recommended that it should be carried forward. They have purchased land at Caerphilly, in a very favourable position, and adjoining the railway, on which to erect gas-works capable of manufacturing all the gas required for the district. When completed, they will considerably reduce the cost of production. The sites of the various small works at which gas is now made will then be used as gasholder storage stations and district depôts for stores. The report was adopted; and the Directors were authorized to issue 5 per cent. preference shares to an amount not exceeding £100,000, under the Company's Act of last session.

During the time the Company, whose General Manager is Mr. A. R. Cawley, have been in existence, they have been compelled, by force of circumstances, to devote their time and money to the development of the water portion of the undertaking, leaving the gas portion to practically look after itself. This is shown by the fact that the water capital rose from £50,353 in 1901 to £132,369 last year; whereas the gas capital increased only from £46,698 to £58,900. The heavy capital expenditure on the water plant, however, has now practically come to an end, and attention is being turned to the gas business. Houses are being built at the rate of about 1100 per annum. There are already 9000 connected for water, but only 850 gas consumers; one village of 800 houses, all put up since 1898, not having a foot of gas-main laid in it. Here is scope for the Company's operations. Gas consumption in the district has, however, not been stationary. In 1901, the rentals amounted to £4000, and £149 went to the profit and loss account; whereas last year the figures were £5946 and £932. The water-rentals in 1901 came to £2112, and £1102 was carried to the profit and loss account; while last year the figures were £6964 (after deducting £500 for the purchase of water) and £3686, to which sum, as well as to the £500, have to be added the expenses incurred for temporary pumping arrangements abandoned on the completion of the laying of trunk mains. The Company have made fair progress up to now; and there seems to be a good future before them.

USE OF GAS LIME ON YOUNG GRASS.

In the "Glasgow Herald" for the 7th inst., in the column devoted to agriculture, and under the heading "Use of Gas Lime," the following statement was made by the Agricultural Correspondent of that paper:

An experienced agriculturist directs attention to the harm done in various parts of the country by the application of gas lime to young grass. The indiscriminate use of gas lime has been evident for a long time, despite all the warnings of the intelligent and the scoffings of the experts. At best gas lime is of little value, for it may be classed as genuinely stale "spent" material strongly charged with raw and impure sulphur. Why it should be in favour as a so-termed top-dressing is a mystery. It is of moderate use when harrowed at the fall of the year into the "shin" of fogged-up old pasture lands. But far more benefit, immediate and prospective, would be had, even on such areas, from an application of pure lime or lime compost. Of course, there are odd lots of gas lime which are not quite so bad in the poisoning sense. It does happen occasionally that the gas-works labourer is a little free or extravagant with his fresh lime. As a rule, however, the fault is that the lime is not cleared out until it is supercharged with impurities. To apply such a blend to young grass or tender vegetation of any kind is to subject it to half-burning, half-poisoning. Some may hold that no perceptible harm results from a thin spreading. But where is the good? There ought to be some positive benefit even from application of a low-priced material.

It is evident that if the author of this paragraph is an experienced agriculturist, he has derived very little profit from his experience. For instance, he has not learned that lime has the same action upon vegetation in all parts of the world, for he begins by saying that it has done harm "in various parts of the country." Then he has not learned that lime, as a fertilizer, is not intended for application to the foliage of plants, but to the roots. If lime is placed upon the leaves of a plant or the petals of a flower, its effect will be to destroy what it rests upon, and then, when it gets into the soil, to build up the plant into a healthier life. But so would any other form of manure. Would a gentleman who might have paid £1500 for an orchid plant sprinkle the flower of it with any manure—powdered bone, superphosphate, slag, or sulphate? The author speaks of the lime not being cleared out until it is supercharged with impurities. Did he ever put in a crop of any kind, or see one put in, because, for the purpose of fertilization, something which is very impure, and the more impure the better, is always applied at the root of the plant? A correspondent who has called our attention to this communication points out that it will do harm, because everyone will not take time to consider it in its true bearing, but will probably act up to it, and discard the use of gas lime.

No notice was taken of the matter till last Friday, when reference was made to it in the "Herald." A correspondent, writing from well-known chemical works, said: "I can speak from my own knowledge,

derived from forty years' experience, that gas lime is not taken advantage of by farmers as it ought to be. Of course, care must be exercised in its application." He enclosed a copy of a printed letter sent to the manager of a large gas-works, speaking highly of the use of gas lime at the fall of the year, and when applied as a compost made up with potato shaws. "It would be strange if those who are largely interested in the sale of gas lime were to condemn its use either in pure or in compost form. The fact that a certain communication from a lavish spreader of gas lime has been printed shows that the clearing out of the spent, sulphur-charged product is not quite so easy as it was in the last century. It has its own sphere of influence; but that sphere should not touch young grass in late spring." This statement is a slight improvement upon the first one; but it is only a halting recommendation of gas lime, and leaves much to be desired as a vindication of the article as a stimulator of vegetation.

GAS AND ELECTRIC LIGHTING IN BUENOS AYRES.

In the "JOURNAL" last week, it was announced that the Directors of the Primitiva Gas and Electric Lighting Company of Buenos Ayres, Limited, recommend the payment of a dividend of 7 per cent. per annum on the ordinary shares for the past year. We learn from the report to be presented at the forthcoming annual general meeting that the amount available for the purpose is £44,986, which has been produced as follows: The balance on the revenue account and the interest received from the German Transatlantic Electricity Company, with £122 received from transfer fees, making a total of £122,520. Adding the amount carried forward (£16,469) brings this up to £138,989. Deducting the debenture interest, discount and commission, London expenses, two dividends on the preference shares, and an amount required to complete the reserve against "discount on debentures and expenses of issue"—in all £93,003—there remains the above-named sum of £44,986. The payment of the dividend will absorb £28,000, and leave £16,986 to be carried forward. The sale of surplus lands resulted in a profit of £20,611; and certain receipts for interest, and other adjustments, amounting to £1893, added to this profit, make a total of £22,504; and the Directors have thought it advisable to devote this amount, together with £22,285 from the profit and loss account, and £9304 from the special reserve fund, to extinguishing in the balance-sheet the item of £54,093, "Discount on debentures and expenses of issue." The increase in the sales of gas and in the use of cookers and stoves was maintained during the year; and the Company's works were kept in efficient repair.

Water-Works Purchase at Beverley.—The Beverley Corporation have decided to purchase the undertaking of the local Water Company. The price agreed upon is £20,850.

GAS-ENGINES FOR PUMPING SEWAGE.

At the Meeting of the London County Council last Tuesday, the Main Drainage Committee reported that they had considered tenders submitted to them for the supply and fixing of three gas-engines required at the new pumping-station to be erected in Bermondsey in connection with flood relief works. Four firms (Messrs. Crossley Bros., Limited, Messrs. Fielding and Platt, Limited, the Campbell Gas-Engine Company, Limited, and the British Westinghouse Electric and Manufacturing Company, Limited) had submitted tenders; the amounts ranging from £9565 to £10,987. A condition of the tender was that specifications and drawings, showing the general outline and sectional arrangement of the engines offered, should accompany it. The Westinghouse Company, however, were the only firm who complied strictly with these terms; but, in the circumstances, the Committee thought it well to give the other firms an opportunity of rectifying their omission, and the necessary additional particulars were eventually received. The Committee were advised that the engines which would be most suitable for the work required were those offered by the Campbell Gas-Engine Company and the Westinghouse Company; but even in these cases certain modifications were necessary, and both firms were willing to do what was required. The Westinghouse Company had intimated that, as a result, they were able to reduce the amount of their tender by £1000; and the Committee thought it should be accepted at the lower amount, and recommended that the estimate submitted for the work referred to be approved and the expenditure sanctioned. When the Chairman of the Committee (Mr. T. Penn Gaskell) moved the reception of the report, Mr. Thomas asked whether, after the contracts had been opened, one of the tendering firms "undercut" the successful firm (the Campbell Gas-Engine Company), and why the contract was given to any other than the firm whose tender was lowest (Messrs. Crossley). Mr. Gaskell explained that the firm in question had not built in this country any engines of the kind required, and consequently had no samples which could be shown. In the case of Messrs. Fielding and Platt, they had only built two engines; and the Committee felt that this was no very great experience. The Campbell Gas-Engine Company were building the engines for the Falkland Brook Company; and therefore the Committee thought it would be more advantageous to go to the Westinghouse Company, whose experience had been large in the class of engine specially required. It was a question of having the best contract; and in accepting the tender of the Westinghouse Company, the Committee were guided by the interests of the Council. Mr. Thomas said the explanation given was not satisfactory; and he thought the Council were entitled to something more. He therefore moved, as an amendment, that the matter be referred back to the Committee. Mr. Collins seconded the amendment, which, after a rather warm discussion, was carried.

CARBURETTED WATER-GAS APPARATUS

Merrifield—Westcott—Pearson Patents.

The Economical Gas Apparatus Construction Co., Ltd.

W. H. PEARSON, Chairman.
W. H. PEARSON, Junr., Deputy-Chairman
J. T. WESTCOTT, Manager.
L. L. MERRIFIELD, M.Inst.M.E., Engineer.

London Offices: 19, ABINGDON STREET, WESTMINSTER, S.W.
American Offices: TORONTO. TELEGRAPHIC ADDRESS: "CARBURETED, LONDON."

CARBURETTED WATER-GAS ENGINEERS.

The above Company have erected since 1893, or are now erecting, their Universal Type of Carburetted Water-Gas Plant at the following Gas-Works:—

	Cub. Ft. Daily.		Cub. Ft. Daily.		Cub. Ft. Daily.
Blackburn	1,250,000	Buffalo, N.Y.	2,000,000	Newcastle-on-Tyne	1,800,000
Windsor St. Works, Birmingham	2,000,000	Winnipeg, Man.	500,000	Leeds	1,800,000
Saltley Works, Birmingham	2,000,000	Colchester (Second Contract)	300,000	Malton	150,000
Colchester	300,000	York	750,000	Smethwick	500,000
Birkenhead	2,250,000	Rochester	500,000	Gravesend	300,000
Swindon (New Swindon Gas Co.)	120,000	Kingston, Ont.	300,000	Pernambuco, Brazil	125,000
Saltley, Birmingham (Second Contract)	2,000,000	Crystal Palace District	2,000,000	Duluth, (Second Contract)	300,000
Windsor St., Birmingham (Second Contract)	2,000,000	Duluth, Minn.	300,000	Leicester (Second Contract)	1,000,000
Halifax	1,000,000	Caterham	150,000	Newport (Second Contract)	250,000
Toronto	250,000	Leicester	2,000,000	Brockville	250,000
Ottawa	250,000	Enschede, Holland	150,000	Toronto (Third Contract)	750,000
Lindsay (Remodelled)	125,000	Buenos Ayres (River Plate Co.)	700,000	Montreal, Ont. (Second Con.)	1,800,000
Montreal	500,000	Burnley	1,500,000	Toronto (Fourth Contract)	1,000,000
Toronto (2nd Cont., Remodelled)	2,000,000	Kingston-on-Thames	1,750,000	Hamilton, Ont.	400,000
Belleville	250,000	Accrington	500,000	Rochester (Third Contract)	1,600,000
Ottawa (Second Contract)	250,000	Tonbridge	300,000	Leeds (Second Contract)	900,000
Brantford (Remodelled)	200,000	Stretford	500,000	Buenos Ayres (Primitiva Co.)	1,200,000
St. Catherines (Remodelled)	250,000	Oldbury	300,000	Buenos Ayres (New Co.)	1,200,000
Kingston, Pa.	125,000	Todmorden	500,000	Christchurch, N.Z.	300,000
Peterborough, Ont.	250,000	Saltley, Birmingham (Third Contract)	2,000,000	Rochdale	1,600,000
Wilkesbarre, Pa.	750,000	York (Second Contract)	750,000	St. John's, Newfoundland	250,000
St. Catherines (Second Cont.)	250,000	Rochester (Second Contract)	500,000	Brantford (Second Contract)	400,000
		Newport (Mon.)	250,000	Smethwick (Second Contract)	500,000
		Tokio, Japan	1,000,000	Pontypridd	250,000
				Montreal (Third Contract)	1,800,000

And, in addition, COAL GAS PLANTS at NELSON, B.C., CHATHAM, BERLIN, NAPANEE, OWEN SOUND, CALGARY, and WINNIPEG.

MANCHESTER LAND PURCHASE ARBITRATION.

Last Tuesday, at the Surveyors' Institution, the proceedings opened in an arbitration to determine the price to be paid by the Manchester Corporation to the Earl of Wilton for 70 acres of land near Heaton Park, on which it is proposed to construct a service reservoir. The Arbitrators were Mr. Bousfield for the Earl of Wilton, and Mr. John B. Wallis for the Corporation, with Sir John Rolleston as Umpire. Sir Edward Boyle, K.C., and the Hon. R. W. Coventry appeared for the Earl of Wilton; and Mr. Balfour Browne, K.C., and Mr. Edmund Sutton, for the Corporation.

In opening the case for the Earl, Sir Edward Boyle explained that some time ago Manchester acquired Heaton Park from him, for a sum of £230,000; and when this land was disposed of, it was naturally thought that the surrounding area would be increased in value for building purposes. The Trustees of the estate had sold 32 acres at £400 an acre in 1894, and 4 acres at £863 per acre in 1903. They knew that coal existed below the surface; and the Corporation seemed to be aware of the fact also. The Trustees did not want to sell the coal. They were willing to reserve the rights; but if the Corporation wanted the coal, it must be paid for.

Evidence was then called, and several architects and surveyors stated their views as to the value of the land for building purposes. Mr. Alexander Stenning thought the 70 acres were worth £36,000—40 acres at £600, and 30 acres at £400 an acre. In addition, he allowed 10 per cent., or £3600, for compulsory purchase, and £2500 for rebuilding farmhouses demolished by the Corporation. He considered that 100 acres would be greatly depreciated by the reservoir; and he valued this depreciation at £75 an acre, or £7500, while he put the mining rights at £7000—making his total valuation £56,600. The next witness, Mr. Howard, made his net valuation £45,725, exclusive of mineral rights; while Mr. Robert Evans considered that £54,050 (including £7000 for the coal) would be a fair figure. Mr. H. H. Campbell, a mining engineer, said he had sunk a borehole in the neighbourhood, and found a band of coal 11 inches thick, at a depth of 684 yards. He calculated that at a depth of 1197 yards there was a seam of coal 31 feet thick. He estimated the value of the coal rights at £6597.

In submitting the case for the Corporation, Mr. Balfour Browne asked the Umpire to get out of his mind the many things stated for the Earl of Wilton and not proved. The evidence that £863 an acre was given for 4½ acres of land was founded on hearsay; and, moreover, his learned friend, Sir Edward Boyle, had himself urged the absurdity of comparing the purchase price per acre of an estate of 690 acres with the purchase price per acre of an estate of 70 acres. He did not believe that Lord Wilton took a farthing less for the property than he could screw out of the Corporation. As a matter of fact, he was paid the full value, and a large sum for solatium, because it had been his family residence. The land was purely agricultural; and as for building in the neighbourhood, there was none. The witnesses for the claimant had pitched on two little houses which had been erected on another property. The land was a drug in the market, and would not sell. There was no workable coal there, though, of course, he was willing to admit that coal might be found at a non-workable depth.

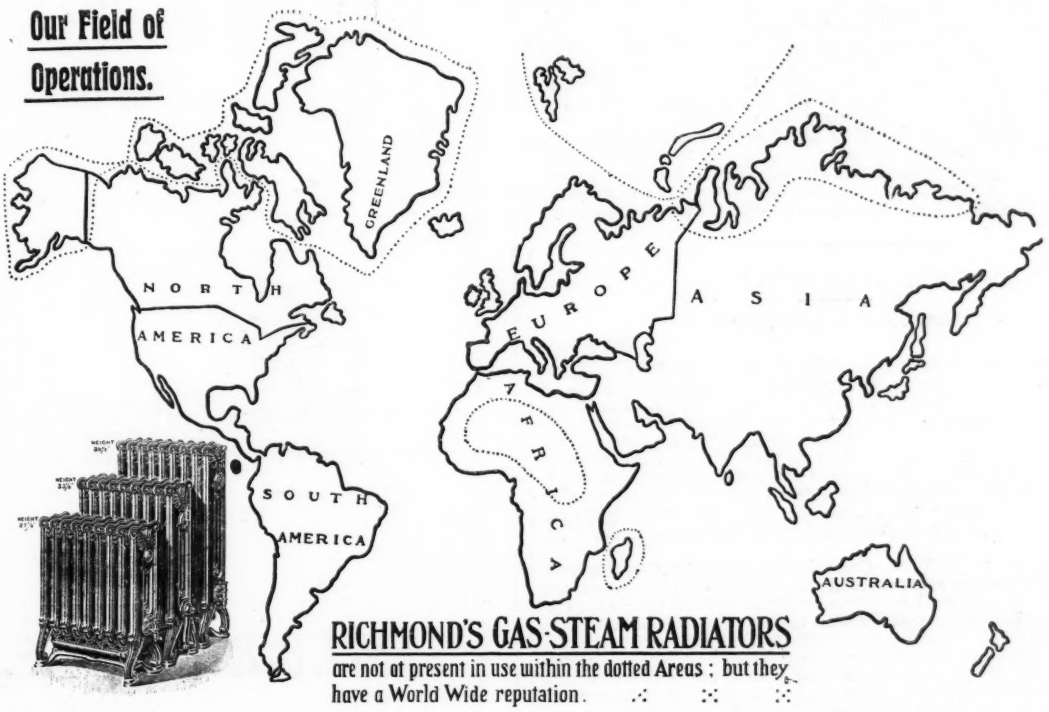
The first witness for the Corporation was Mr. Wainwright, a surveyor, who said the land was merely agricultural, and there was no facility for building in the ordinary sense of the term. He considered that fully 30 years must elapse before the land in the neighbourhood of the 70 acres would be really suitable for building. He did not think that the sale of Heaton Park was any guide to the value of the 70 acres. The park was worth fully £100 to £150 an acre more than that property. Allowing £150 an acre as the value of the 70 acres, £2000 for the rebuilding of the farmhouses, and £50 for the necessary re-arrangement of the field, he put his total valuation as £12,464. Two other surveyors—Messrs. T. S. Wilson and Joshua Bury—arrived at a precisely similar figure; and then Mr. Joseph Dickinson, a mining engineer, gave it as his opinion that there was no workable coal beneath the surface. This concluded the case for the Corporation; and the hearing of Counsels' arguments was adjourned to Thursday, the 26th inst.

PROGRESS OF THE DERWENT WATER SCHEME.

There has recently been issued to the authorities constituting the Derwent Water Board a report on the proceedings of the Board during the year ending Dec. 31. It contains a good deal of information relating to the progress of the scheme for which the Board obtained parliamentary powers in 1899, and which when completed will furnish a large additional supply of water to Derby, Leicester, Nottingham, and Sheffield.

The stone required for the works is being obtained from the Board's quarries at Bore Hill. According to the report, the present estimate of the quantity required for the two reservoir dams now in course of construction is about 1,200,000 tons, and 235,000 tons were sent from the quarries during last year; making, with the 160,000 tons sent before Jan. 1, 1905, a total output of 395,000 tons. The Engineer (Mr. E. Sandeman, M.Inst.C.E.) considers that very much more stone can be obtained from the quarries than is required for the first instalment of the works. Up to Dec. 31, 1904, the Board had expended on the quarries, including the land acquired for them, the construction of railways, cableways, huts, temporary buildings, plant, cost of quarrying, &c., £92,114; and the net expenditure during last year was £34,956; making a total of £127,070, of which £74,505 has been charged to other works for value of stone transferred.

Dealing with the reservoir works, the report states that at Howden the estimates are for excavation 250,000 cubic yards and for masonry



Advertisement of the RICHMOND GAS STOVE & METER CO., LTD.
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320,000 cubic yards. At the end of 1904, the excavation completed was about 152,000 cubic yards, and to this must now be added 7500 cubic yards of work done during 1905; making a total amount of 159,500 cubic yards of excavation at the end of December. About 24,000 cubic yards of concrete masonry had been built into position previous to last year; and to this amount were added during the year about 63,129 cubic yards of concrete masonry and stone facing together—making a total of 87,129 cubic yards of masonry completed. The quantity of water pumped from the workings during the year averaged 701,000 gallons per day. The Derwent was again diverted during the year, and is now running through a concrete culvert in the solid masonry of the dam. The cost of the Howden works to the end of 1905 was £164,191.

The estimated totals for excavation and masonry in the case of the Derwent dam are 320,000 cubic yards and 360,000 cubic yards respectively. The figures of the work completed at the end of the year were: Excavation, 14,000 cubic yards; masonry, 67,200 cubic yards. The pumping work here is not so heavy as at Howden; the daily average of the water pumped out of the trench being 570,000 gallons. The cost of the Derwent works to Dec. 31 amounted to £158,231.

Tenders were invited during the year for works comprising a length of aqueduct from Ashopton to Grindleford and the Bamford filter-beds; but the offers received not being, for various reasons, considered satisfactory, it was decided to advertise again early in the present year, when probably the whole length of the Derwent to Grindleford section (with the filters) will be included in one contract. Section B of the main aqueduct of the Board extends from Grindleford to Rowsley; and the work of construction was let during the year to Mr. George Bell, of Tottenham and Manchester. He commenced operations on the 12th of July last; and on the 31st of December a total length of 1929 yards of pipes had been laid. On all the sections of the aqueduct, while the tunnel and cut-and-cover work is being constructed with a view to dealing with the full supply of the completed scheme, only one line of pipes is at present being laid. The amount expended to Dec. 31 was £41,483. The construction of the next section from Rowsley to Whatstandwell was commenced by Messrs. Morrison and Mason, Limited, of Polmadie, Glasgow, in the early part of 1904, and has been steadily pushed forward. The section is a heavy one, owing to the large proportion of tunnel work. On Jan. 1, 1905, about 520 yards of tunnel had been driven, of which about 180 yards had been lined with concrete. On the 31st of December last, the position of the work on the three tunnels stood as follows: Total length driven, 2547 yards; ditto, lined, 1436 yards. On the Bentley syphon, 1625 yards long, 1480 yards of pipes have been laid; and the Lea syphon, 5514 yards long, has been completed. The total length of pipe-line on the section is 8403 yards; and practically all the pipes have been delivered by the contractors.

There are now four locomotives at work on the railway, and 300 waggons, which latter travel over the Midland Company's line between Bamford and Grindleford (for the sidings to the quarries). The total sum expended on the construction and maintenance of the railway and plant at the close of 1904 was £93,493; and a further sum of £12,639 was expended during 1905. The total expenditure to the end of the latter year, therefore, was £106,132. At the beginning of the present year, ten more huts for workmen were in course of erection at the Birchinlee Village; the contract, exclusive of foundations, amounting to £865. The population of the village at the end of 1904 was 727; and at the end of 1905, 844—all the huts being occupied. The cost during 1905 was: Construction, £100; maintenance, £252—the totals to the end of the year being £31,794 and £10,836 respectively. The revenue amounted to £4196; making the total to the close of the year £14,191. At the end of 1904, there had been paid for lands and easements required for the purposes of the works, but exclusive of the lands taken for the sites of the quarries, the sum of £116,902.

The twelvemonth bills issued in March (£50,000) and September, 1904 (£100,000), were paid off without any further issue being made. The moneys required by the Board are being obtained on mortgages—the longest term being seven years; and during the year under review a net sum of £492,060 was raised, the rate of interest varying from 3½ to 3¾ per cent.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

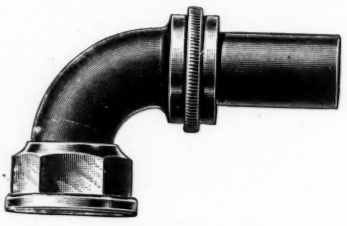
The Ayr and Newton Consumers' Gas Company, of which Mr. John Gibbs is Manager, yesterday inaugurated a very extensive scheme of renovation of the works of the Company at Damside, Ayr. I am sorry I am unable to give any description of the reconstructed works; but the Chairman of the Company, "in his modesty," thinks there is no need for a report in a technical journal. I only know that the alterations have cost about £10,000, which indicates that the work has been very considerable. The company which was invited to take part in the inaugural ceremony was a large one, including the shareholders, with lady friends, and a number of managers of gas-works in the West of Scotland.

In the Edinburgh Town Council this week, the Cleaning and Lighting Committee recommended the erection of 120 electric arc lamps, or such additional number as might be resolved upon after the Inspector of Lighting had submitted a further report which he was instructed to make, specifying the streets which, in his opinion, could with advantage and economy be lighted by electric arc lamps; also that the arc lamps so authorized be placed on tramway routes and adjacent streets so far as these were suitable, and that the remaining flat-flame gas-lamps be converted into 2½ cubic feet inverted incandescent gas-lamps, the cost of the lanterns being spread over three years. Mr. Wilson, the Convener of the Committee, said the proposal meant improved lighting, not in a few selected streets, but everywhere throughout the whole city; and it would remove the reproach of flat-flame burners. The scheme would cost £10,000, which would be spread over three years; but this sum would include the cost of an increased staff and more efficient attendance for the lamps. The Convener expressed his indebtedness in the matter to Mr. Newington,

SAWER & PURVES

Stove Fittings.

STOVE BEND.



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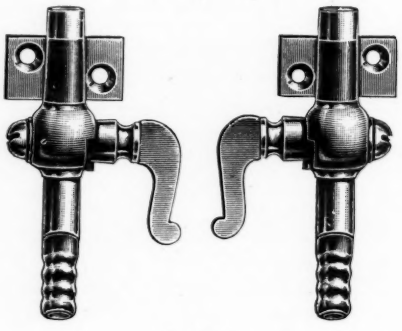
WING HOB TAPS.



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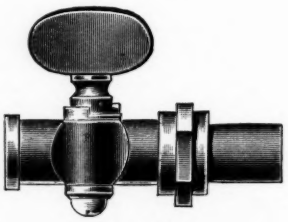
STOVE TAP.



No. 110.

SAWER & PURVES,

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the Electrical Engineer, and to Mr. Herring, the Gas Engineer. No mention was made of the Inspector of Lighting, who does not seem to have had much share in the formulating of the proposal. A lengthy discussion took place, and ultimately the recommendation was varied by the omission of the reference to the additional arc lamps, and was then adopted by a large majority. This action by the Council is presumably the outcome of the deliberations of the Committee upon the report of Mr. John F. Simmance, of London, on the subject of the public lighting, given in the "JOURNAL" for Dec. 19 last. If that be so, everyone being satisfied with what is to be done to improve the street lighting, the report will not now be adopted, but will be in the hands of the Committee until it is forgotten; or it may, after a time, be quietly discharged. The report contained some passages which were a little awkward for the Lighting Authority to get past. By practically homologating, without adopting, the report, they have avoided having to acknowledge their past remissness. The community have thus benefited by Mr. Simmance's report.

Mr. A. I. Strachan, the Treasurer to the Dundee Corporation Gas Department, having died recently, the duties of the office fall, in terms of his appointment, to Mr. A. W. Stiven, who already holds the offices of City Chamberlain and Police Treasurer. It has been proposed in the Town Council this week that Mr. Stiven should be granted an increase of £100 a year to his salary, raising it to £700, in respect of the additional duties laid upon him. Mr. Brownlee considered that £100 was not sufficient for the post, and he suggested that it should be made £200. The question of salary was sent to the Lord Provost's Committee for consideration.

CURRENT SALES OF GAS PRODUCTS.

Week ending April 14.

Sulphate of Ammonia. LIVERPOOL, *April* 12.

There has again been a quiet market, foreign buyers being already under contract for the bulk of their requirements, and not being in any hurry to make supplementary purchases. Home demand is satisfactory, but is not enough to affect prices materially. The closing quotations consequently remain £12 5s. per ton f.o.b. Hull, £12 6s. 3d. per ton f.o.b. Liverpool, and £12 7s. 6d. per ton f.o.b. Leith. Inquiries in the forward position do not lead to important business, there being a difference of about 5s. per ton between the views of large buyers and sellers.

Nitrate of Soda.

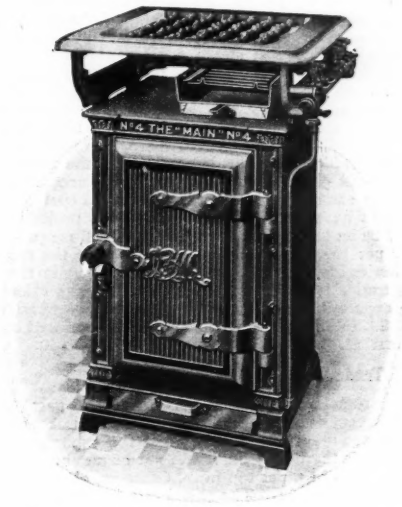
This article is very firm on spot, and the agreement to renew the combination of producers has strengthened the market in the forward position. Spot prices are 11s. 6d. per cwt. for 95 per cent., and 11s. 9d. per cwt. for refined.

Tar Products. LONDON, *April* 12.

There is really very little business doing, doubtless owing to the approach of the holidays. So far as pitch is concerned, the largest London makers are still firm in their ideas; but dealers are evidently prepared to accept lower prices than those quoted by manufacturers. There has been rather more inquiry from the Continent, doubtless owing to the fear of labour troubles in France; but no actual improvement has taken place, as evidently most consumers are well stocked for early delivery, and they prefer waiting a little before contracting forward at improved prices. So far as Yorkshire is concerned, it is reported that business has taken place at slightly improved prices for next season's delivery; but particulars have not transpired. In Lancashire, there are still sellers for shipment from Liverpool and Manchester; and this certainly at present seems to be the cheapest point, as in more than one instance makers appear to have fairly large stocks. There has been a fairly good business doing in 90 per cent. benzol, principally for gas enriching purposes, though it is reported that a fairly large contract has been arranged in the North of England for home consumption. 50-90 per cent. appears neglected at present; and consumers do not take much interest in same, though small sales are reported in the Liverpool district. In solvent naphtha, for prompt delivery prices are fairly well maintained; but forward is certainly easier, and it appears more than likely that rather lower figures are being accepted for home consumption over the last six months of the year. There is really nothing whatever doing in anthracene, and prices are purely nominal. It does not seem likely that much interest will be taken in this article for some time to come; consumers being very well supplied, and makers are decidedly indifferent as to the position of the article. Carbolic acid keeps firm, though it is difficult to understand what consumers are paying the prices which are reported to have been realized by certain manufacturers here. There is undoubtedly a very good demand for both prompt and forward delivery; but makers are certainly asking more than consumers appear willing to pay as a general rule. Crystals are fairly steady, and there seems to be a very good inquiry, especially for forward delivery. In creosote, so far as London is concerned, the market is very well maintained, and there appears to be a fairly good demand, especially for early delivery. There is rather more offering in the Lancashire district; but in Yorkshire, makers are very firm in their ideas for both prompt and forward delivery. In toluol, the price is well maintained; but there is really no business doing, owing to the fact that no manufacturers are at present offering anything for either prompt or forward delivery.

Average values during the week were: Tar, 16s. to 21s. Pitch, London, 27s. 9d. to 28s.; east coast, 26s. 6d. to 27s.; west coast, 24s. 6d. to 25s. Benzol, 90 per cent., 9¼d. to 9⅜d.; 50-90 per cent., 10¼d. to 10⅜d. Toluol, 1s. 0⅜d. to 1s. 1d. Crude naphtha, 4¼d.; solvent naphtha, 1s. to 1s. 1d.; heavy naphtha, 11d. to 11⅛d. Creosote, London, 1⅜d.; North, 1⅜d. to 1 7/16d. Heavy oils, 2⅛d. to 2¼d. Carbolic acid, 60 per cent., 1s. 9¾d. to 1s. 10d. Refined naphthalene, £4 10s. to £8; salts, 20s. to 20s. 6d. Anthracene, "A" quality, 1½d. to 1⅝d.; "B" quality, unsaleable.

The "MAIN" *Gas Cooker*



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Sulphate of Ammonia.

The market for this article continues very quiet, and, owing to the Easter Holidays, there is absolutely no business doing. Beckton's price is still nominally £12 12s. 6d., though there is little doubt that if they were offered £12 10s. they would accept; but there are second-hand sellers of Beckton at under this. In Hull, the market is quiet, and business is reported at equal to £12 5s. Hull terms. In Liverpool, a few small parcels are reported to have been sold at prices ranging from £12 5s. to £12 7s. 6d. In Leith, the market is steady. Makers would probably accept £12 10s.; but there are no bids at this price.

COAL TRADE REPORTS.

Lancashire Coal Trade.

Considerable activity is being displayed in Lancashire among the mining population with regard to a desired increase in the rate of wages, which is just now in abeyance. The rise of 5d. per ton in all classes of engine fuel may be said to have been generally adopted, and, so far as we have been able to gather, causes no dissatisfaction. The Royal and Coal Exchanges were closed on Good Friday and Easter Monday. Business during the last few days has been practically at a standstill. Last week's quotations hold good.

Northern Coal Trade.

The coal trade in the North has felt naturally the influence of the holidays. The demand for coal has been good, and up to Thursday night the production was heavy; but there will now be for some days very little coal coming to the ports. This and the labour difficulties abroad have made the position very strong; and the price is firm, but irregularly so. For best steam coals, there is a good demand. Northumbrian kinds are quoted from 11s. 9d. to 12s. per ton f.o.b., second-class steams being 10s. 9d. to 11s., and steam smalls 6s. 6d. to 7s. 6d. The gas coal trade is active for a season that is usually one of quietness; for some orders for France have been rather pressed and heavier exports have been made there, and may continue to be made for some little time. This has influenced the prices, which are firm at from about 9s. 3d. to 10s. per ton f.o.b., according to quality. There has been something done in the great gas coal contracts; but the exact prices have not yet transpired. It is probable that, after all, there will be an advance in the prices that will range from perhaps 7d. to 10½d. per ton, according to the quality of the coal—the best gas-coal collieries seeming to show up the strongest in the price. As to the coke trade, it is firmer this week; but gas coke is not yet being freely exported. The current quotation on Newcastle Exchange is from 10s. 8d. to 11s. per ton f.o.b.; and the reduced output seems to ease the market.

Scotch Coal Trade.

Trade has remained unchanged; being still in great volume, and with every prospect of continuing so. There is a talk of prices going up a little, but the movement is slow; and the expectation is growing that, whatever rise there may be, it will not be much. The quotations are: Main 7s. 9d. to 8s. per ton f.o.b. Glasgow, ell 9s. 3d. to 10s. 6d., and splint 9s. 3d. to 9s. 6d. The shipments for the week amounted to 268,471 tons—a decrease of 3235 tons upon the preceding week, but an increase of 54,210 tons upon the same week of last year. For the year to date, the shipments have amounted to 3,253,841 tons—an increase of 306,636 tons upon the corresponding period of 1905.

Water Supply for Cairo.—A Cairo correspondent of "The Times" states that the official inauguration of the new artesian wells of the Cairo Water Company took place at Rodel Farag on the 19th ult., in the presence of the Khedive and a large and distinguished company, which included Lord Cromer, the Ministers, and most of the representatives of the Powers. The analysis of the water obtained from experimental borings at Rodel Farag having proved to be eminently satisfactory, the Government and the Water Company decided in 1903 to substitute well water for that obtained from the Nile. The work commenced in the spring of 1904, and the first wells, with their installation of machinery, were in working order by the 1st of June in the following year. At present twelve wells, 197 ft. to 213 ft. in depth, have been sunk. The more wells are to be sunk, and another machine installed, in the near future. Their completion will make it possible to supply Cairo daily with 22 million gallons of water, of a quality equal to that supplied to any European capital.

Serious Gas Explosion on the South-Eastern Railway.—A serious gas explosion occurred, late last Thursday night, near Belvedere Road, Lambeth, on the South-Eastern Railway. It appears that an engine-driver, who had driven his engine too far, found two of his wheels taken off at the catch-point; and the wheels dropping off caused a fracture in the gas pipe supplying light to Hungerford Bridge. The escape which resulted was not at first perceived; but when the relief party came to restore the engine-wheels they smelt the gas. One of them immediately went to seek for the origin of the escape, and, it being dark, carried a light with him. An explosion followed, throwing down and burning three of the workmen, who had to be removed to Charing Cross Hospital. Two of them were severely burnt about their faces and arms, and were detained; but the third was allowed to go home after his injuries had been attended to. Meanwhile, the flames from the leaking gas were a source of danger to the adjacent property. There seemed to be no other course to be taken than to turn off the gas supply from the main; but this would have extinguished the signals on Hungerford Bridge, on a night which was unusually busy, owing to the holiday traffic. However, by throwing a quantity of dust and *débris* on the pipe, the remaining workmen succeeded in smothering the flame, and the danger ceased.

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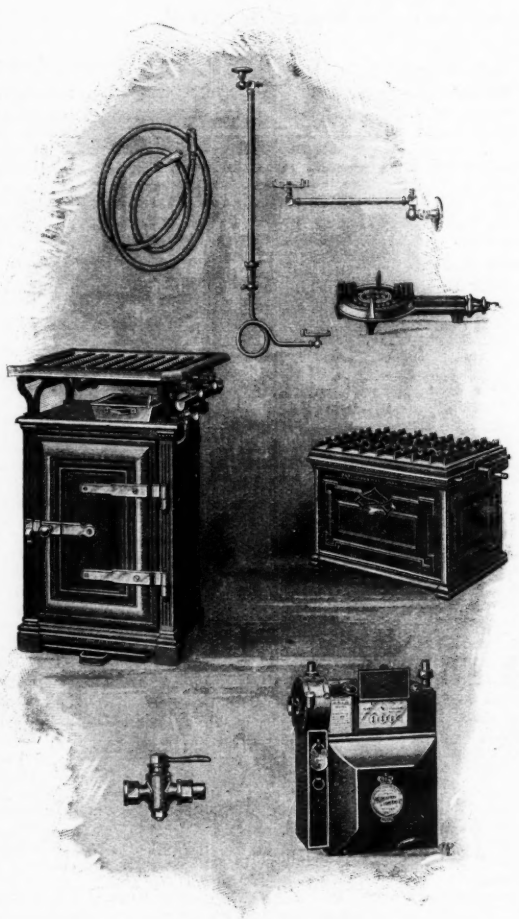
INSTALLATIONS.



PARKINSON AND W. & B. COWAN, LTD.

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Carlisle Gas Stokers' Hours and Conditions.—At the monthly meeting of the Carlisle City Council, a lengthy discussion took place with respect to an application by the gas stokers, &c., for improved hours and conditions of labour and wages. Mr. G. Coulthard explained that the Gas Committee, of which he is Chairman, had offered the men an 8-hour shift, provided they did the same amount of work as on a 9½-hour shift. During that time they really only worked 2½ hours at the retorts, and received 39s. 4½d. a week. This proposal, however, did not satisfy the men, who wanted also an increase in their wages. Mr. Watson moved that the subject be referred back, with instructions to the Committee to receive a deputation of the men. This was accepted by Mr. Coulthard on behalf of the Committee.

Increase in the Capital of the Imperial Continental Gas Association.—After the ordinary meeting of the Association on the 1st prox., a special meeting will be held, at which the following resolutions will be submitted: "That, in pursuance of the statutory power of the Association in this behalf, the nominal capital of the Association be increased from £3,800,000 to £4,940,000 by appropriating for this purpose £1,140,000 from the sum or sums applied from time to time out of revenue to the extension and improvement of the works of the Association, and to other purposes to which capital was properly applicable." "That the increased capital of £1,140,000 be issued in the form of capital stock ranking *pari passu* with that already issued, and be allotted to the present proprietors, free of cost, in proportion to their holdings, at the rate of £3 for every £10 now registered in their names."

Public Lighting of Portrush.—At a special meeting of the Portrush Urban District Council, the Lighting Committee submitted a report in which they recommended that a deputation should wait on the Gas Company in order to ascertain what better means of street lighting they proposed to supply during the coming season. The Committee also recommended the Council to approach Messrs. Curran and Co., as to the probable cost of installing an electric plant sufficient to meet the requirements of the public and private lighting of the district, and to learn for what sum the firm would be prepared to light the streets in the event of the Council permitting them to instal the necessary plant. The report further stated: "The Committee desire to give expression to the feeling that the Council, as a public body, have always been badly treated by the Gas Company in the supply of sufficient and good light for street lighting purposes." After a lively discussion, it was decided that both parties should be approached.

Gas-Works and Thames Pollution.—The Conservators of the Thames have issued their annual report, showing the action taken by them for the purification of the river and its tributaries during the twelve months ended Dec. 31 last. The following cases were specified: The Gaslight and Coke Company have spent £10,000 on the Beckton Gas-Works in order to comply with the Conservators' notice served in 1895. The satisfactory character of the effluent from the works was not maintained last year; but, as the result of correspondence, an improvement has been recently effected. At the East Greenwich works of the South Metropolitan Gas Company, improvements have been made in the treatment of the refuse water, and samples of the effluent are now stated to be generally satisfactory.

We have received from Messrs. R. & A. Main, Limited, their latest list of gas cooking and heating appliances. These are arranged in four sections—the first consisting of porcelain enamelled and other cookers; the second, of large cooking apparatus for hotels, hospitals, restaurants, &c.; the third, of fires and heating-stoves of ornamental designs for houses, including gas-heated steam radiators; and the fourth, of bolt, iron, and water heaters and tailors' stoves. A full-page illustration shows a hotel or restaurant kitchen fitted throughout with the Main prize medal gas-cooking apparatus. The new list under notice is an excellent example of the improvements which modern photography and typography have effected in the production of trade catalogues; the majority of the large quarto pages occupied with the illustrated descriptions of Messrs. Main's specialities being quite artistic productions. The catalogue proper is preceded by a few remarks on the advantages of cooking and heating by gas; and there is a numerical as well as a general index.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

MANAGER. No. 4585. Applications by April 28.
GAS MANAGER. Tavistock Lighting, Coal, and Coke Company. Applications by April 21.
JUNIOR DRAUGHTSMAN. No. 4584.
EXHIBITION ATTENDANT AND CANVASSER. No. 4587

Situation Wanted.

MAIN AND SERVICE LAYER. No. 4586.

Automatic Gas Meter Arrangement Wanted.

BRAUN AND CO., Stuttgart.

Plant (Second-Hand) for Sale.

PURIFIERS AND GASHOLDER. Yorktown and Blackwater Gas Company.

Stocks and Shares.

NEWCASTLE AND GATESHEAD WATER COMPANY. May 8.

TENDERS FOR

Coal and Cannel.

BARNOLDSWICK GAS DEPARTMENT. Tenders by May 1.
CRANLEIGH GAS COMPANY. Tenders by April 30.
MONTROSE GASLIGHT COMPANY. Tenders by April 23.
ULVERSTON GAS AND WATER DEPARTMENT. Tenders by April 26.
WATFORD GAS COMPANY. Tenders by May 7.
WIDNES GAS DEPARTMENT. Tenders by May 1.

Light Oil.

BRIDGEWATER COLLIERIES COKE-WORKS. Tenders by April 23.

Meters, Tubes, &c.

BANGOR (CO. DOWN) GAS DEPARTMENT. Tenders by April 24.
MORLEY CORPORATION GAS DEPARTMENT. Tenders by April 21.

Oxide of Iron.

EDINBURGH AND LEITH GAS COMMISSIONERS. Tenders by April 20.

Sulphuric Acid.

MIDDLESBROUGH GAS DEPARTMENT. Tenders by April 21.

Tank (Cast Iron) and Joists.

COVENTRY GAS DEPARTMENT. Tenders by April 30.

Tar and Liquor.

MIDDLESBROUGH GAS DEPARTMENT. Tenders by April 21.
MORLEY CORPORATION GAS DEPARTMENT. Tenders by April 21.
ULVERSTON GAS DEPARTMENT. Tenders by April 26.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 158.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
500,000	10	Apl. 11	10½	Alliance & Dublin 10 p.c.	21—22*	..	4 15 5
160,000	10	,,	7½	Do. 7 p.c.	14½—15½*	..	4 16 9
200,000	5	Nov. 15	7	Bombay, Ltd.	6¾—7¼	..	4 16 7
40,000	5	,,	7	Do. New, £4 paid	4¾—5¼	..	5 6 8
50,000	10	Mch. 9	14	Bourne-mouth Gas and Water } 10 p.c. . .	28½—29½	..	4 14 11
51,810	10	,,	7	} B 7 p.c. .	16½—17½	..	4 0 0
53,200	10	,,	6	} Pref. 6 p.c.	15—16	..	3 15 0
380,000	Stk.	Feb. 22	12½	Brentford Consolidated	263—268	+1	4 13 3
300,000	,,	,,	9¾	Do. New	197—202	+2	4 14 1
50,000	,,	,,	5	Do. 5 p.c. Pref. .	123—128	..	3 16 11
206,250	,,	Dec. 14	4	Do. 4 p.c. Deb. .	105—108	+2	3 14 1
220,000	Stk.	Mch. 9	11½	Brighton & Hove Orig.	230—235	..	4 15 9
246,320	,,	,,	8½	Do. A. Ord. Stk. .	163—168	..	4 18 3
460,000	20	Apl. 11	10	British	42½—43½*	..	4 11 11
100,000	Stk.	Feb. 22	6	Bromley, Ord. 5 p.c. .	121—124	+1	4 16 9
165,700	,,	,,	4½	Do. do. 3½ p.c. .	92—95	+1	4 14 9
500,000	10	Oct. 13	7	Buenos Ayres (New) Ltd.	12¾—13¼	+¼	5 5 8
250,000	Stk.	Dec. 29	4	Do. 4 p.c. Deb. .	97—99	..	4 0 10
150,000	20	Mch. 9	8½	Cagliari, Ltd.	23—25	..	6 12 0
100,000	10	Sept. 28	10	Cape Town & Dis., Ltd.	17—17½	..	5 14 3
100,000	10	Oct. 27	4½	Do. 4½ p.c Pref.. .	10—10½	..	4 5 9
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	53—55	..	5 9 1
50,000	Stk.	Dec. 29	4½	Do. 4½ p.c. Deb. Stk.	100—102	..	4 8 3
1,443,280	Stk.	Feb. 22	5⅛	Commercial 4 p.c Stk. .	114—116	..	4 9 7
560,000	,,	,,	5	Do. 3½ p.c. do. .	111—113	..	4 8 6
475,000	,,	Dec. 14	3	Do. 3 p.c. Deb. Stk.	85—87	+1	3 9 0
800,000	Stk.	,,	6½	Continental Union, Ltd.	129—132	..	4 18 6
200,000	,,	,,	7	Do. 7 p.c Pref.	143—148	..	4 14 7
432,070	Stk.	Feb.	5½	Derby Con. Stk. . . .	122—124	..	4 8 9
55,000	,,	Jan.	4	Do. Deb. Stk. . . .	105—107	−3	3 14 9
486,090	10	Jan. 25	11	European, Ltd. . . .	23—24	..	4 11 8
354,060	10	,,	11	Do. £7 10s. paid	17—18	..	4 11 8
15,223,235	Stk.	Feb. 8	4⅝	Gas-light and Coke } 4 p.c. Ord. . .	98—99	..	4 8 11
2,600,000	,,	,,	3½	} 3½ p.c. max. . .	88—90	..	3 17 9
3,799,735	,,	,,	4	} 4 p.c. Con. Pref.	109—111	+1	3 12 1
4,193,975	,,	Dec. 14	3	Coke } 3 p.c. Con. Deb.	88—90	..	3 6 8
258,740	Stk.	Mch. 9	5	Hastings & St. L. 3½ p.c.	98—102	..	4 18 0
82,500	,,	,,	6½	Do. do. 5 p.c.	121—124	..	5 4 10
70,000	10	Apl. 11	11	Hongkong & China, Ltd.	19½—20½*	..	5 7 4
3,800,000	Stk.	Nov. 15	10	Imperial Continental .	235—237	+3	4 4 5
473,600	Stk.	Feb. 8	3½	Do. 3½ p.c. Deb. Red.	96—98	..	3 11 5
175,242	Stk.	Mch. 28	6	Lea Bridge Ord. 5 p.c. .	121—126	..	4 15 3
561,000	Stk.	Feb. 22	10	Liverpool United A . .	235—237	..	4 4 5
718,100	Stk.	Feb. 22	7	Liverpool United B .	163—170	..	4 2 4
306,083	,,	Dec. 29	4	L'rpool Unit'd Deb. Stk.	109—111	..	3 12 1
75,000	5	Dec. 14	5	Malta & Medn., Ltd. .	4¼—4⅜	..	5 5 3
560,000	100	Apl. 2	5	Met. of } 5 p.c. Deb..	101—103	..	4 17 1
250,000	100	,,	4½	Melbourne } 4½ p.c. Deb.	102—104	..	4 0 7
541,920	20	Nov. 15	3½	Monte Video, Ltd. . .	11½—12½	..	5 12 0
1,675,892	Stk.	Feb. 22	4⅝	Newc'tle & G'tesh'd Con.	107—109	..	4 4 10
406,625	Stk.	Dec. 29	3½	Do. 3½ p.c. Deb.	98—100	..	3 10 0
15,000	10	Mch. 9	10	North Middlesex 10 p.c.	19—20	..	5 0 0
52,940	1/	,,	7	Do. 7 p.c.	12½—13½	..	5 3 8
300,000	Stk.	Nov. 30	8	Oriental, Ltd. . . .	150—153	..	5 4 7
600,000	5	Mch. 28	7	Ottoman, Ltd. . . .	6—6½	..	5 7 8
398,490	5	Apl. 28	7†	Primitiva Ord. . . .	7—7½	..	4 13 4
796,980	5	Jan. 25	5	Do. 5 p.c. Pref. .	5¼—5½	..	4 10 11
488,900	100	Dec. 1	4	Do. 4 p.c. Deb. .	98—100	..	4 0 0
851,070	10	Oct. 13	7	River Plate Ord. . . .	13½—14	+½	5 0 0
300,000	Stk.	Dec. 29	4	Do. 4 p.c. Deb. .	98—100	..	4 0 0
250,000	10	Mch. 28	8	San Paulo, Ltd. . . .	14—14½	..	5 8 6
70,000	50	Jan. 2	5	Do. 5 p.c. Deb. .	50—52	..	4 16 2
135,000	Stk.	Mch. 28	10	Sheffield A	244—246	..	4 1 4
209,984	,,	,,	10	Do. B	243—245	..	4 1 8
523,498	,,	,,	10	Do. C	243—245	..	4 1 8
126,106	Stk.	Mch. 9	5½	Shrewsbury Ord. 5 p.c.	108—118	..	4 13 3
70,000	10	Sept. 28	10	South African	16½—17½	+½	5 14 3
6,250,000	Stk.	Feb. 22	5½	South Met., 4 p.c. Ord.	127—129	..	4 5 3
1,895,445	,,	Jan. 11	3	Do. 3 p.c. Deb.	88—90	..	3 6 8
575,000	Stk.	Mch. 9	5½	S'th Suburb'n Ord. 5 p.c.	120—123	..	4 9 5
60,000	,,	,,	5	Do. 5 p.c. Pref. . .	125—130	..	3 16 11
112,533	,,	Jan. 11	5	Do. 5 p.c. Deb. Stk.	132—137	..	3 13 0
502,310	Stk.	Nov. 15	5	Southampton Ord. . .	109—112	..	4 9 3
120,000	Stk.	Mch. 9	6¼	Tottenham and } A 5 p.c. . .	124—127	..	4 18 5
363,020	,,	,,	4¾	} B 3½ p.c. .	99—102	..	4 13 2
137,500	,,	Dec. 14	4	Edmonton } 4 p.c. Deb.	105—107	..	3 14 9
182,380	10	Dec. 29	8	Tuscan, Ltd.	10¼—10¾	..	7 8 10
149,900	10	Jan. 2	5	Do. 5 p.c. Deb. Red.	99—101	..	4 19 0
30,000	Stk.	Feb. 22	7⅜	Wands-worth and } A 5 p.c. . .	—	..	—
255,636	,,	,,	6¼	} B 3½ p.c. . .	133—136	..	4 11 11
75,000	,,	,,	5⅛	} C 3½ p.c. . .	110—113	..	4 16 0
69,416	,,	Dec. 29	3	Putney } 3 p.c. Deb. Stk.	82—85	..	3 10 7
745,872	,,	Mch. 9	5⅛	West Ham 5 p.c. Ord. .	107—109	..	4 14 0
185,000	,,	,,	5	Do. 5 p.c. Pref. . .	122—125	..	4 0 0
193,300	,,	Dec. 29	4	Do. 4 p.c. Deb. Stk.	106—109	..	3 13 5

Prices marked * are "Ex. div." † Next dividend will be at this rate.

Messrs. F. C. Sugden and Co., of Leeds, have, among other contracts, received further repeat orders for regenerator settings and iron-work from the Gomersal, Kirkheaton, Mablethorpe, and Parsonstown Gas-Works.

The Directors of the Buenos Ayres (New) Gas Company, Limited, recommend, subject to final audit, a dividend of 4 per cent., or 8s. per share, free of income-tax, for the six months ended Dec. 31 last; making 7 per cent. for the year 1905, and carrying forward £22,808.

The costs of the abortive Newquay Improvement Bill are reported to be £1123, and they will have to be paid by the Urban District Council. In their action in regard to the promotion of this measure, the Council (and it may be hoped the ratepayers) will have learnt a salutary lesson.

The Holderness Gas Company have instructed the Richmond Gas Stove and Meter Company, Limited, to undertake the development of their district at Withernsea (the new gas-works for which town are described and illustrated in another part of the "JOURNAL"), and an exhibition and canvass will shortly be held. The Richmond Company are also to fit up complete automatic installations.

The Chemical Engineering Company and Wilton's Patent Furnace Company have recently obtained the following contracts: Complete sulphate of ammonia plants for the Sunbury, Kilsyth, and Chippenham Gas-Works (the last through Messrs. Edward Cockey and Sons, Limited, of Frome), and also for remodelling the sulphate plant at the Hythe Gas-Works, including the supply of a new liquor-still, &c.; and tar-distillation plant for the San Paulo Gas-Works.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

TERMS OF SUBSCRIPTION to the "JOURNAL."

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All Communications, Remittances, &c., to be addressed to WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.
Telegrams: "GASKING, LONDON." Telephone: P.O. 1571a Central.

OXIDE OF IRON.

O'NEILL'S OXIDE
For GAS PURIFICATION.
LARGEST SALE OF ANY OXIDE.

SPENT OXIDE PURCHASED IN ANY DISTRICT.

GAS PURIFICATION & CHEMICAL CO., LD.
PALMERSTON HOUSE,
OLD BROAD STREET, LONDON, E.C.

WINKELMANN'S
"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
ANDREW STEPHENSON, 182, Palmerston House, Old Broad Street, London, E.C. "Volcanism London."

BROTHERTON & CO., LIMITED.
Offices: Commercial Buildings, LEEDS.
Correspondence invited.

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of Special SULPHURIC ACID, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol, which has now been used for upwards of 50 Years. References given to Gas Companies.

"VITERNUS" METALLIC PAINT FOR GAS-WORKS PLANT.
JOHN E. WILLIAMS AND CO.,
LOWER MOSS LANE,
MANCHESTER, S.W.
Telegrams: "ENAMEL." National Telephone 1759.

AMMONIACAL Liquor wanted.
BROTHERTON AND CO., LTD., Ammonia Distillers, Works: BIRMINGHAM, GLASGOW, LEEDS, LIVERPOOL, AND WAKEFIELD.

GAS OILS.
MEADE-KING, ROBINSON, & CO.
Represent the Strongest Independent Refineries in America; also Petroleum Spirit for Gas Enrichment. 8, EXCHANGE STREET, MANCHESTER, and 11, OLD HALL STREET, LIVERPOOL.

GAS TAR wanted.
BROTHERTON AND CO., LTD., Tar Distillers. Works: BIRMINGHAM, GLASGOW, LEEDS, LIVERPOOL, AND WAKEFIELD.

GLASS SHADES of every description, for all kinds of Interior **GAS LIGHTING.**
Illustrated sheets on application.
JOHN WALSH WALSH,
SOHO AND VESTA GLASS WORKS, BIRMINGHAM.
Telegrams: "VESTA, BIRMINGHAM."
National Telephone: No. 63.
London Show-Room: 4, HOLBORN CIRCUS, E.C.

SULPHURIC ACID for Sale, specially suitable for making Sulphate of Ammonia.
BROTHERTON AND CO., LTD., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM, and 54 & 47, Westminster Bridge Road, LONDON, S.E.
WET AND DRY GAS-METERS, PREPAYMENT METERS, STATION METERS, AND GOVERNORS.
REPAIRS RECEIVE PROMPT ATTENTION.
Telephones: 254 Oldham, and 2412 HOP, London.
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GASHOLDER PAINTING.
PAINTING Work for all kinds of Gas- Works Plant, Roofs, Bridges, &c., undertaken by Contract or otherwise.
FREDERICK BOYALL, 31, Regent's Row, DALSTON, N.E.

TEMPERLEY TRANSPORTERS
FOR Rapid and Economical Handling of Coal and Coke in Gas-Works.
Next Illustrated Advertisement will appear on April 24.
TEMPERLEY TRANSPORTER COMPANY,
72, BISHOPSGATE STREET WITHIN, LONDON, E.C.
Telephone: 365 LONDON WALL. Telegrams: "TRANSUMO."

TAR AND LIQUOR WANTED.
Best Prices paid.
DENT AND CO.,
Ouse Chemical Works, SELBY.

SULPHATE OF AMMONIA SATURATORS and all LEAD and TIMBER WORK in Connection with Sulphate Plants.
We guarantee promptness, with efficiency for Repairs.
JOSEPH TAYLOR AND CO., CENTRAL PLUMBING WORKS, BOLTON.
Telegrams: SATURATORS, BOLTON. Telephone 0848.

GAZINE—A radical Solvent and Pre- ventative of Naphthalene deposits, which has been used for many years on the Continent for the cleaning of Mains and Services, and is now being adopted in England. It is also used for the Enrichment of Gas, and has an Illuminating Value of double that of 90 per cent. Benzol.
Supplied by C. BOURNE, 120, Manor House Road, NEWCASTLE-ON-TYNE.

PATENTS AND TRADE MARKS
PUBLICATIONS, "MERCHANDISE MARKS ACT, and Decisions thereunder," 1s.; "TRADE SECRETS v. PATENTS," 6d.; "DOCTRINE of EQUIVALENTS, Mechanical and Chemical," 6d.; SUBJECT-MATTER of PATENTS," 6d.
MEWBURN, ELLIS, & PRYOR, Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C. Telegrams: "Patent London." Telephone: No. 243 Holborn.

OXIDE OF IRON.
(NATURAL.)
BALE & CHURCH will be pleased to send Quotations and Samples on application.
SPENT OXIDE PURCHASED.
BALE'S FIRE CEMENT for all Retort and Furnace work.
PAINT for Gasholders, Purifiers, &c.
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SPECIALLY prepared for the Manu- facture of SULPHATE OF AMMONIA.
SPENCER, CHAPMAN, & MESSEL, LTD.
(with which is amalgamated WM. PEARCE & SONS, LTD.),
36, Mark Lane, LONDON, E.C. Works: SILVERTOWN.
Telegrams: "HYDROCHLORIC, LONDON."
Telephone 341, AVENUE.

TO WATER AND GAS COMPANIES REQUIRING CAPITAL.
THE Water and Gas Debenture Share Investment Trust, Limited, of 37, High Street, Tunbridge Wells, are prepared to Invest £10,000 Capital in above, and also to Underwrite Progressive Water and Gas Companies' issues.

HYDRATED OXIDE OF IRON.
PREPARED from Pure Iron.
Twice as Rich as Bog Ore.
Gives no Back Pressure.
The Cheapest in the Market.
Can be Exchanged for Spent Oxide.
READ HOLLIDAY AND SONS, LTD., HUDDERSFIELD.

WANTED, a Situation by a Young Man (Age 27) as MAIN and SERVICE LAYER; also well up in Fitting. Midlands preferred.
Address No. 4586, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GAS-WORKS MANAGER.
WANTED, an Experienced and Thoroughly Competent MANAGER, conversant with every branch of Economical Manufacture and Distribution, including Maintenance of Plant, Main Laying, &c. Complete personal superintendence indispensable.
Production about 140 Millions.
Commencing Salary, £200, with House (free of Rent, Rates, and Taxes), Fuel, Light, and Water. Duties to commence in September next.
Apply, by letter, on or before April 28 next, with Three Testimonials, to No. 4585, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

THE Tavistock Lighting, Coal, and Coke Company, Limited, invite APPLICATIONS for the position of GAS MANAGER. Annual make, 18 Millions. Salary, £100 per annum, with House, Coal, and Gas. Must thoroughly understand the Manufacture (especially Regenerator Settings) and Distribution of Gas.
Applications, stating Age, and Experience, with *copies* of Three recent Testimonials, to be sent by letter only, addressed to Mr. H. T. Doble, Chairman of Directors, Gas-Works, Tavistock, South Devon, not later than the 21st of April, 1906.
Any further Particulars may be obtained from
A. FRANCIS,
Secretary.
April 4, 1906.

ROBERT DEMPSTER & SONS, Ltd., Contractors for Complete CARBONIZING PLANTS and every description of GAS APPARATUS and ELEVATING and CONVEYING PLANT, ROSE MOUNT IRON-WORKS, ELLAND.

EXHIBITION Attendant and Canvasser required by a well-known Gas-Stove Firm.
Apply, by letter, giving Experience, &c., to No. 4587, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by large Railway Company, a JUNIOR DRAUGHTSMAN, used to Photometric work. Wages, 35s.
Apply, stating Age, Qualifications, and Experience, to No. 4584, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a good Arrangement of AUTOMATIC GAS-METER.
Send Drawings and full Particulars to J. BRAUN & Co., STUTTGART.

WANTED, Copper Scrap, 72s.; Brass, 48s.; Zinc, 16s.; Lead Ashes, 8s. Also old Wet Gas-Meters bought.
ROSSE WORKS, Leeds Road, BRADFORD.

GAS-MAIN Pipes, Clean and Perfect, Second-Hand 10-inch, 8-inch, 6-inch, 5-inch. Large Stock, drawn from Sockets, no broken ends, from £3 10s. to £4 10s. delivered, according to distance.
FIRTH BLAKELEY AND Co., Thornhill, DEWSBURY.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters. Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

GAS PLANT FOR SALE.

THE Yorktown and Blackwater Gas Company have FOR SALE: Two 10-feet square PURIFIERS, with 6-inch Connections and Valves complete, in first-class condition.
Also a small GASHOLDER, 25 feet diameter and 12 feet deep, with Columns, Chains, and Balance-Weights complete (without Tank).
Any reasonable Offers will be considered.
For further Particulars apply to the undersigned.

J. MEIKLEJOHN,
Engineer and Manager.

April 11, 1906.

URBAN DISTRICT OF BANGOR (CO. DOWN).

(GAS DEPARTMENT.)

THE Council of the above District in- vite TENDERS for the supply of DRY METERS for One Year from the 1st of May, 1906.
Meters are to be delivered at the Gas-Works, Bangor, carriage paid.
Further Particulars can be had, if required, from the Gas Manager, Mr. B. Mitchell.
Tenders, endorsed "Meters," will be received by me till Twelve o'clock noon on Tuesday, the 24th of April, 1906.
The lowest or any Tender not necessarily accepted.

JAMES MILLIKEN,
Clerk of the Council.

Town Hall, Bangor,
Co. Down, April 12, 1906.

URBAN DISTRICT COUNCIL OF BARNOLDSWICK.

THE above Council invite Tenders for the supply of 4000 Tons of best screened GAS COAL, delivered free on rail, Barnoldswick Station (Midland Railway) or Canal Wharf (Coates), between July 1, 1906, and June 30, 1907, in such quantities monthly as required.
The Council reserve the right to divide the quantity between two or more Contractors.
The Council do not bind themselves to accept the lowest or any Tender.
Forms of Tender supplied on application to the undersigned.
Tenders must be on the prescribed Forms, and addressed to the Chairman, Gas Committee, Town Hall, Barnoldswick, and delivered not later than Tuesday, May 1, 1906.

J. W. THOMPSON,
Manager.

Town Hall, Barnoldswick.

TENDERS FOR GAS COAL.

THE Directors of the Watford Gas and Coke Company invite TENDERS for the supply of their requirements of GAS COAL for One, Two, or Three Years at the rate of 10,800 Tons (more or less) per annum.
The Coal to be screened or unscreened and to be delivered at the Bushey Station of the London and North Western Railway commencing July 1, 1906.
Forms of Tender and all Information may be obtained on application, in writing only, to me, the undersigned.
Tenders must be on the Form supplied, any alteration of which will invalidate the Tender.
Tenders to be delivered on or before the 7th day of May, 1906, addressed to the Chairman of the Watford Gas and Coke Company, Watford, endorsed "Tenders for Gas Coal."
The Directors do not bind themselves to accept the lowest or any Tender.

J. DUNCAN ROYAL,
Secretary.

Watford Gas and Coke Company's Offices,
Watford, April 12, 1906.

THE Directors of the Cranleigh Gas and Coke Company, Limited, invite TENDERS for the supply of good GAS COAL to May 30, 1907.
Quantity required, about 750 Tons.
Coals to be delivered at Cranleigh (L.B. & S.C. Rly.) Station as ordered by the Secretary.
Sealed Tenders, marked "Coal," to be sent to me not later than the 30th of April, 1906.
The Directors do not bind themselves to accept the lowest or any Tender.

H. J. HAYMAN,
Secretary.

Cranleigh, April 11, 1906.

MONTROSE GAS LIGHT COMPANY.

TENDERS FOR COAL.

THE Directors invite Tenders for the supply of about 3000 Tons of Best Quality Screened GAS COAL, delivered f.o.r. or f.o.b. in such quantities as may be required till May 31, 1907.
Sealed Tenders, addressed to the undersigned and endorsed "Tender for Coal," to be sent in not later than Monday, the 23rd of April.
The Directors reserve to themselves the right to divide the quantity into two or more Contracts, and do not bind themselves to accept the lowest or any Offer.

By order,
A. MACKAY,
Engineer and Manager.

Montrose Gas-Works.

ULVERSTON URBAN DISTRICT COUNCIL.

TO TAR DISTILLERS.

THE Gas and Water Committee are prepared to received TENDERS for the purchase of the surplus TAR produced at their Gas-Works during the Year commencing July 1 next.
Further Information and Forms of Tender may be had on application to the undersigned.
Sealed Tenders, endorsed "Tender for Tar," and addressed to the Chairman of the Gas and Water Committee, to be sent in not later than the 26th inst.
The Committee do not bind themselves to accept the highest or any Tender.

JNO. SWAN,
Engineer and Manager.

April 12, 1906.

ULVERSTON URBAN DISTRICT COUNCIL.

TENDERS FOR CANNEL.

THE Gas and Water Committee are prepared to receive TENDERS for screened CANNEL for a period of One, Two, or Three Years commencing the 1st of July next.
Parties Tendering must give full Particulars of the Cannel they propose to supply, and name the pit from which the same will be raised.
Further Information and Forms of Tender may be obtained from the undersigned.
Sealed Tenders, endorsed "Tender for Cannel," and addressed to the Chairman of the Gas and Water Committee, to be sent in not later than the 26th inst.
The Committee do not bind themselves to accept the lowest or any Tender.

JNO. SWAN,
Engineer and Manager.

TO IRONFOUNDERS, &c.

THE Gas Committee of the Coventry Corporation invite TENDERS for the supply and erection of a CAST-IRON COVERED TANK, 25 feet by 17 feet by 5 feet deep; also for JOISTS and PLATES to form floor of Pump House, 12 feet by 20 feet.
Copies of Specification, General Conditions, Form of Tender, with Bill of Quantities and prints of Drawings, will be supplied on application to the undersigned and upon payment of Ten Shillings, which will *not* be returned.
The Committee do not bind themselves to accept the lowest or any Tender.
Tenders must be delivered, addressed to the Chairman of the Gas Committee, Gas-Works, Coventry, not later than the first post on Monday, the 30th inst.

FLETCHER W. STEVENSON,
Engineer and General Manager.

Gas-Works, Coventry,
April 12, 1906.

BRIDGEWATER COLLIERIES COKE-WORKS.

(THE EARL OF ELLESMERE.)

TENDERS are invited for the Light OIL produced at the above Works for a period of Six or Twelve Months from the 1st of May, 1906, delivered into Contractor's Tanks at the Bridgewater Colliery Siding, Wharton Hall, on the Pendleton and Hindley branch of the Lancashire and Yorkshire Railway; or at the Brackley Siding on the Little Hulton Mineral branch of the London and North-Western Railway.
Tenders, endorsed "Tender for Light Oil," to be addressed to Mr. Thomas M. Brown, Bridgewater Coal Office, 4, Chapel Walks, Manchester, on or before the 23rd of April, 1906.
Manchester, March 23, 1906.

BOROUGH OF MIDDLESBROUGH.

(GAS DEPARTMENT.)

TAR AND SULPHURIC ACID.

THE Gas Committee invite Tenders for the purchase of the Surplus TAR made at their Works during the Twelve Months ending June 30, 1907. Also for the supply of SULPHURIC ACID to be used in the Manufacture of Sulphate of Ammonia during the same period.
Particulars may be obtained on application to the undersigned.
Sealed Tenders, endorsed "Tar," &c., to be sent addressed Alfred Sockett, Esq., Town Clerk, Middlesbrough, on or before Saturday, April 21, 1906.

DAVID TERRACE,
Engineer and Manager.

Gas-Works, Middlesbrough.

THE Widnes Corporation are prepared to receive TENDERS for the supply of about 31,000 Tons of GAS COAL (Slack, "through and through," or Screened Coal) for the Year ending the 30th of June, 1907, to be delivered at the Gas-Works, Widnes.
Conditions and Forms of Tender may be obtained from Mr. Isaac Carr, M.Inst.C.E., Gas Engineer, Widnes.
Tenders, endorsed "Gas Coal," to be delivered to the undersigned not later than noon on Tuesday, the 1st prox.
The Corporation do not bind themselves to accept the lowest or any Tender.

H. S. OPPENHEIM,
Town Clerk.

Town Clerk's Office, Town Hall,
Widnes, April 11, 1906.

MORLEY CORPORATION.

(GAS DEPARTMENT.)

TO TAR DISTILLERS AND OTHERS.

THE Gas Committee are prepared to re- ceive TENDERS for the surplus TAR produced at their Works during the Twelve Months ending March 31, 1907.
Particulars may be obtained on application to H. J. Hemingway, Town Hall, Morley.
Endorsed Tenders to be sent to the undersigned not later than Saturday, April 21.

FRED THACKRAY,
Town Clerk.

Town Hall, Morley,
April 12, 1906.

MORLEY CORPORATION.

(GAS DEPARTMENT.)

MISCELLANEOUS GOODS.

THE Gas Committee are prepared to receive TENDERS for the supply of METERS, TUBES, LIME, OIL, and other MISCELLANEOUS GOODS, required by them during the Twelve Months ending March 31, 1907.
Forms of Tender may be obtained on application to H. J. Hemingway, Town Hall, Morley.
Endorsed Tenders to be sent to the undersigned not later than Saturday, April 21.

FRED THACKRAY,
Town Clerk.

Town Hall, Morley,
April 12, 1906.

EDINBURGH AND LEITH CORPORATIONS' GAS COMMISSIONERS.

SPENT OXIDE OF IRON.

THE Commissioners are prepared to re- ceive, till Ten a.m. on Friday, the 20th curt., OFFERS for the REMOVAL of from 600 to 700 Tons of SPENT OXIDE OF IRON containing from 45 to 55 per cent. of Sulphur.
The Material can be despatched either free on rail North British or Caledonian Railways, or free on board ship Granton or Leith Harbours.
Offers, to state the price per unit of Sulphur that will be paid for the quantity desired, to be enclosed in envelopes addressed to the undersigned, and headed "Tender for Oxide."
The Commissioners are not to be bound to accept the highest or any Offer.

JAMES M'G. JACK,
Clerk.

25, Waterloo Place, Edinburgh,
April 11, 1906.

JOSEPH AIRD DECEASED.

PURSUANT TO THE STATUTE 22 AND 23 VICTORIA, CHAPTER 35.

NOTICE is Hereby Given, that all Creditors and other Persons having any debts owing by or any claims or demands against the Estate of Joseph Aird deceased, late of Whitehall Court, London, S.W., and The Wellington Tube Works, Great Bridge, in the County of Stafford, Tube Manufacturer (who died on the 17th day of March, 1906, and whose Will was proved in the Principal Registry of the Probate Division of the High Court of Justice on the 6th day of April, 1906, by Basil Pym Ellis and Henry Hack, the Executors therein named), are hereby required to send Particulars in writing of their debts, claims, or demands to us the undersigned, the Solicitors for the said Executors, on or before the 15th day of June, 1906, and Notice is Hereby Given, that at the expiration of that time the said Executors will proceed to distribute the assets of the said Testator amongst the persons entitled thereto, having regard only to the debts, claims, and demands of which they shall then have had notice, and that they will not be liable for the assets, or any part thereof, so distributed to any person or persons of whose debt, claim, or demand they shall not then have had notice.
Dated this 11th day of April, 1906.

HARGROVE AND Co.
Solicitors for the Executors.

16, Victoria Street,
Westminster, S.W.

NEWCASTLE AND GATESHEAD WATER COMPANY.

TO be Sold by Auction, in the Board Room of the Company's Offices, Pilgrim Street, Newcastle-on-Tyne, on Tuesday, May 8, 1906, at Half-past Twelve o'clock precisely, by

Mr. CHARLES A. JOEL,

in such Lots as are provided for in the said Company's Acts of 1902—

FIFTY THOUSAND POUNDS FIVE PER CENT. PREFERENCE STOCK (1902).

Printed Particulars and Conditions of Sale may be had at the COMPANY'S OFFICES, and Messrs. GEORGE ARMSTRONG AND SONS, Solicitors, NEWCASTLE-ON-TYNE; or of the AUCTIONEER, 27, Northumberland Street, NEWCASTLE-ON-TYNE.

GEORGE SMITH,
Secretary and General Manager.

Newcastle-on-Tyne,
April 2, 1206.

ISSUES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his ISSUES by AUCTION under PARLIAMENTARY POWERS of STOCKS and SHARES in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.

Terms for Issuing such Capital, and also for including Gas and Water Stocks and Shares belonging to Private Owners in these Periodical Sales, can be obtained on application at MR. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

GILBERT LITTLE & CO.'Y LT.D.

Conveyor and Elevator Specialists,
Smethwick, Birmingham.
Make known your wants for Conveyors and Elevators to GILBERT LITTLE, the Pioneer Specialist; he will supply them.

NEWBATTLE CANNEL.
Highest Results in Gas, & Excellent Coke.

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MIRFIELD GAS COAL
UNEQUALLED.
Sperm Value 878·85 lbs. per Ton.

Please apply for Prices, Analyses, and Reports, to the
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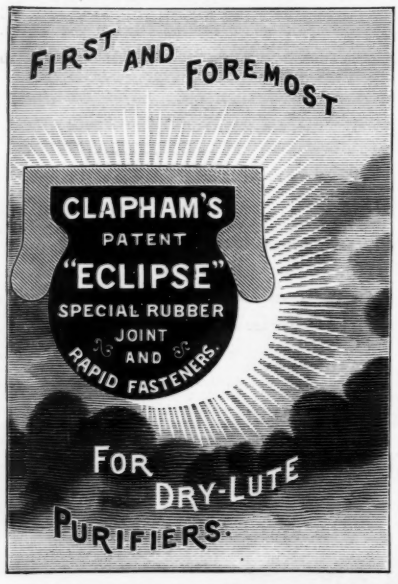
RAVENSTHORPE, NEAR DEWSBURY.
LONDON: 22, Park Village East, N.W.



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Rich in Illuminating Power and yield of Gas
Above the Average in Weight and Quality of Coke.
Maintains a High Standard in Residuals.
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for determining the calorific value of gases
IS MADE BY
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16, DEANSGATE, MANCHESTER,
Gas Engineers' Agents and Contractors for
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Inquiries Solicited.
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Telephone 1806.

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OF THE
STAFFORDSHIRE TUBE CO., LIMITED,
IS STILL
"UNBEATEN
BIRMINGHAM."

THE
"ROTARY"
STATION METER.
Efficiency
Demonstrated.
APPLY—
T. G. MARSH,
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JAMES OAKES & CO.,
ALFRETON IRON-WORKS, DERBYSHIRE,
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Wenlock Iron Wharf, 21 & 22, Wharf Road,
CITY ROAD, LONDON, N.
Manufacture and keep in Stock at their Works (also large Stock in London)
PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS, and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.
NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with Bolts, Nuts, and Covers, and rendering Leakage impossible.

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Wet and Dry Gas Meter Manufacturer.
PREPAYMENT METERS for Pennies, Shillings, or any other Coin.

Wrought-Iron
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LAMBERT BROS., WALSALL,
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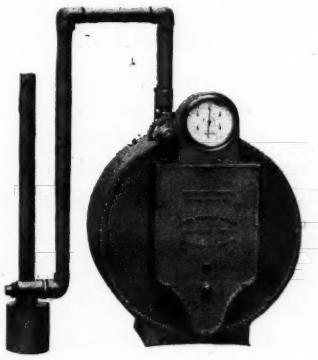
LONDON: LAMBETH BRASS & IRON CO., LTD., 91 & 93, SOUTHWARK ST., S.E.

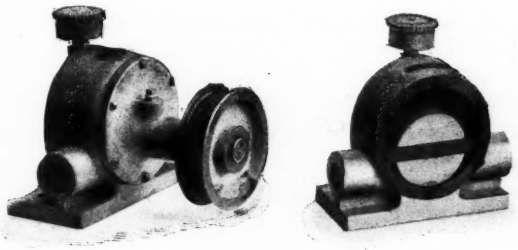
Air Meter & Rotary Blower

FOR AIR SUPPLY TO PURIFIERS.



AIR METER AND SEAL POT.

Cast-Iron Case, Tinned Copper Drum. Indicates $\frac{1}{100}$ths of 1 cubic foot. Fitted with Quadrant Cock and Seal Pot, preventing loss of gas.



ROTARY BLOWER.

(Elevation.) (Section.)

Should be connected to Gas Exhauster so that speed of both is proportionate.

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In almost every department additions have been made; and it is believed that the labour bestowed on its production will enhance the value of the book as a Work of Reference.

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For AMMONIA JOINTS.
For TAR JOINTS.

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Gas, Steam, and other Fuel for Home and Export.

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Full Particulars may be obtained from the Sole Makers,

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[See Illustrated Advertisement, April 3, p. 74.]

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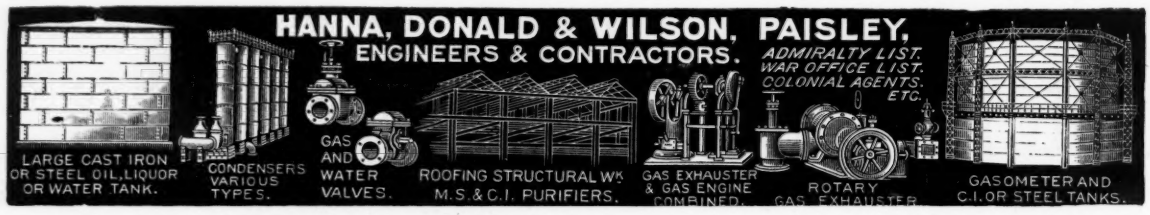
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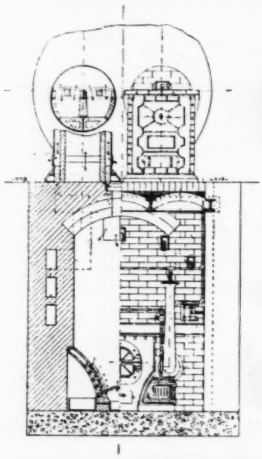

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20 % Saving in Fuel.
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Steady Steam Pressure.
Fuel Employed—Coal or Coke.

Perfect Combustion—17 to 18 % CO_2 in Waste Gases.
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The "Gas World" Analyses of the Accounts of Gas Undertakings show that the HIGHEST RESULTS in GAS MADE and GAS SOLD per Ton of Coal Carbonized were obtained at SCARBOROUGH, where improved Klönne Retort Settings, constructed by us, are SOLELY in use. Many other Towns where these Settings have been adopted are also giving splendid results both as to Gas Made and Coke Sold.

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RADIATE MORE HEAT

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SILCO BRICKS prevent all settling of setting.

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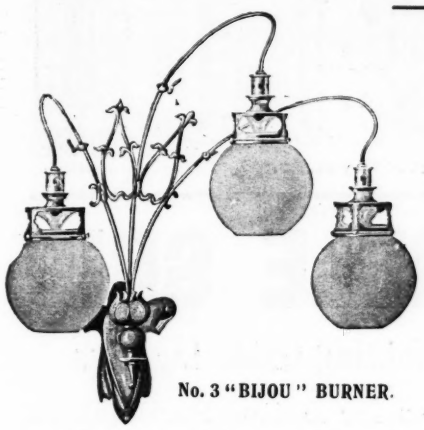

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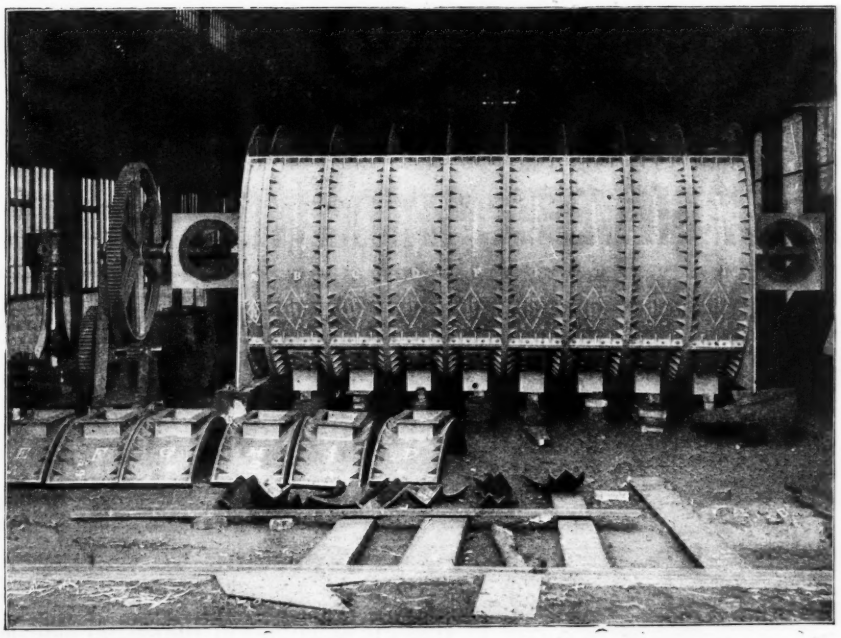

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One of Two Machines supplied by us to a Foreign Gas-Works, photographed in our shops during course of construction.

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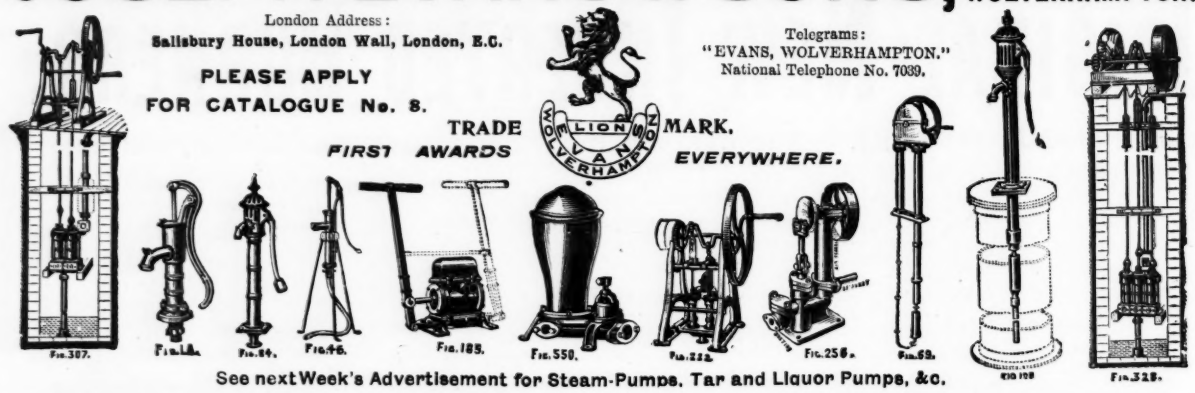

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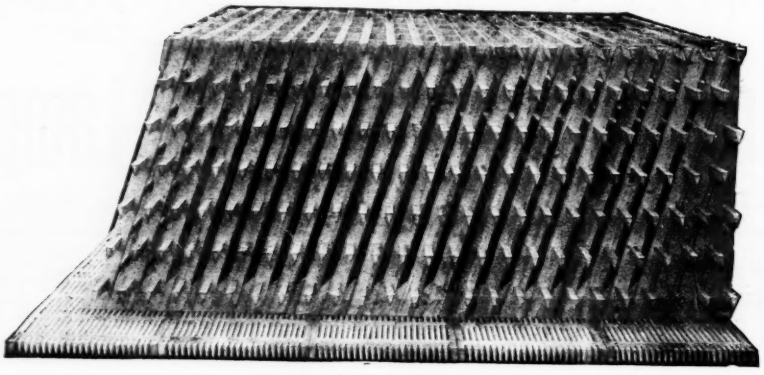
The very best Patent Grid on the Market for Holding Oxide Lightly,

And Holding Oxide Lightly is the Secret of Success for Better Purification.

No Extra Cost in adopting this system to existing Purifiers.

They are Self-Supporting, saving the cost of Standards and Bearers.



Can make the Change from the Old to the New System without any Stoppage.

Simple in Construction and very easy to fix in Position.

The ADVANTAGES with SPENCER'S PATENT HURDLE GRID have been proved during this Winter at several Places, where full Sets have been used:

1—To have passed 50 per cent. more Gas.
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RESULTS GUARANTEED.

Complete Installations of Horizontal and Inclined Retorts.

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LUCAS LAMPS

for indoor and outdoor use, are the most economical form of high-power lighting. From 200 to 1000 c.p. per mantle. Clusters up to 2100 c.p. 40 c.p. per foot of gas consumed. The lamp is simplicity itself, and the light of sunny charm.

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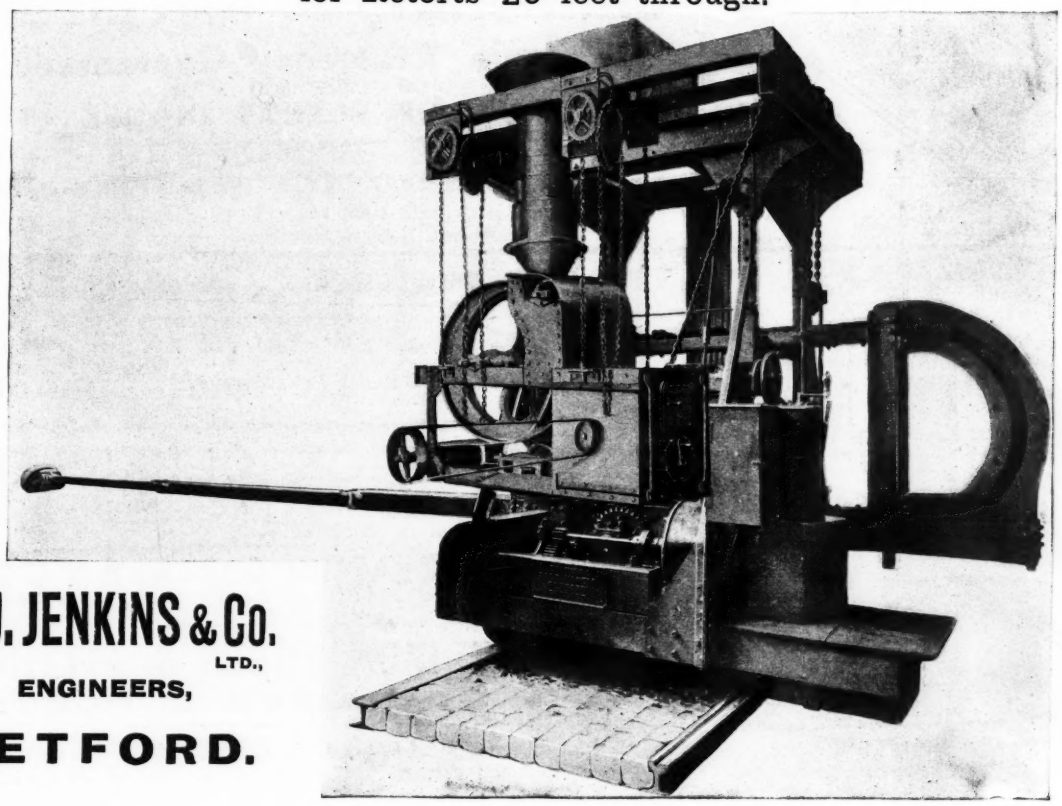
THE COMPLETE STOKER.

Both Discharging and Charging Operations performed by one machine, for Retorts 20 feet through.



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Analysis: 12,600 Feet of 19-Candle Gas per Ton.
Value in Pounds of Sperm, 820·20.

VERY FREE FROM IMPURITIES.

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CAPACITY OF PURIFIERS DOUBLED.
PRESSURE CONSIDERABLY REDUCED.

Special Circular describing the Jäger System of Purification on application.

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Maximum Efficiency Guaranteed.
A LARGE NUMBER OF PLANTS IN OPERATION.

Every Requirement for Gas-Works.
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LAMP TORCHES.

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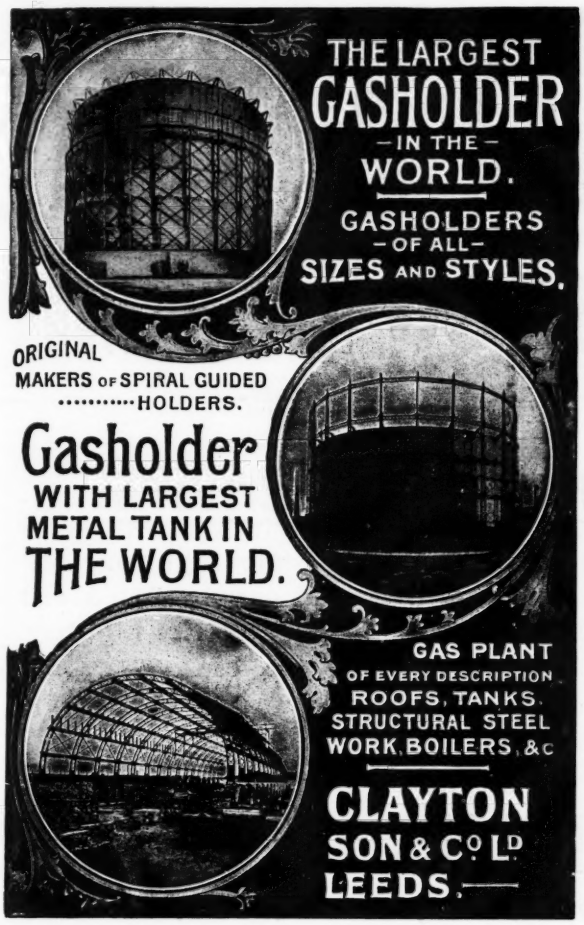

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ESTABLISHED 1860.

LARGEST MANUFACTURERS in the UNITED KINGDOM
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also Makers of Segmental Retorts of all Sections.

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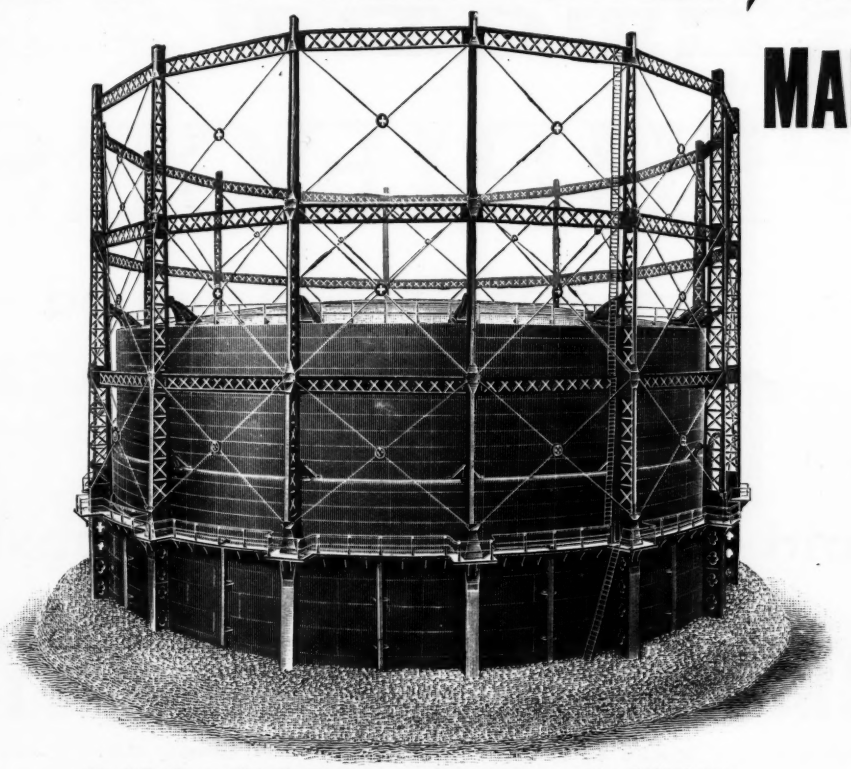

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